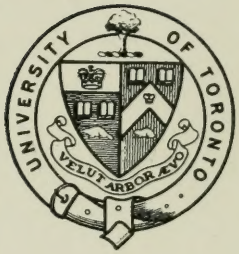

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The Journal

OF THE

Canadian Mining Institute

General Index

Together with Summaries of Papers contained in
Vols. I. to X., inclusive
(1898-1907)

BY
H. MORTIMER-LAMB
SECRETARY

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PREFACE

The value of an alphabetical and analytical index to any work of more than ephemeral importance is too well recognized to need insistence. It frequently happens, however, that, no matter how carefully and conscientiously an index may be prepared, the student or enquirer may be misled, at the cost of much valuable time, by a reference, which when traced to its source proves to be either of minor significance or relevant only indirectly to the subject of enquiry. No system of indexing will provide entirely against this contingency; but the compiler believes he has devised, in the present volume, a method that will at least minimize the difficulty and at the same time facilitate research. The work, it will be noted, is in two sections or parts, the first of which contains brief outlines or summaries of the several papers contributed to the Institute and published in Vols. I to X inclusive of the proceedings. In preparing these summaries, the main aim has been to subordinate them to the purposes and utility of the index, which they supplement. In the index itself, to which the second section of the work is devoted, the names of authors and the titles of papers are distinctively indicated by the employment in the one case of black-letter capitals and in the other of black-letter italics. In each instance, both under the author's name and the paper's title, a reference is given to the page and volume of the Transactions in which the contribution appeared; but, in addition, a reference will be found to a page, in the first section of this book, on which is printed a summary of the paper in question; and by reading this summary the enquirer will in most cases be able to decide whether it will repay him to carry his research further.

Of the first ten volumes of the "Journal of the Canadian Mining Institute," the first five are out of print and unobtainable. Complete or very nearly complete sets of the Transactions are to be found, however, in many institutions or public libraries, of which the following is a list:

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Engineering & Mining Journal, 505 Pearl St., New York City.
Franklin Institute, 15 South 7th St., Philadelphia, Pa.
Journal of Geology, University of Chicago, Chicago, Ill.
Lake Superior Mining Institute, Ishpeming, Mich.
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Summaries of Papers

(Vols. I. to X., Inclusive)

Summaries of Papers

SOME RECENT EXPERIMENTS IN BLASTING WITH COMPRESSED CARTRIDGES

By W. Blakemore

(Vol. 1, pp. 2.-9.)

The objections to the use of black powder are shown to be:

1. Liability to fire gas.
2. Liability to fire coal dust.
3. Heavy production of smoke.

The author recommends for blasting in coal mines the use of the "compressed cartridge," made from the best grain blasting powder composed of 75 parts of refined saltpetre, 10 parts of pure sulphur and 15 parts best alder charcoal, compressed into a cylindrical cartridge varying in diameter from 1 3-16 in. to 1¾ in.; and 2½ in. in length. The pressure employed is 10 tons to the square inch and some harmless glucose coherent is used to ensure a solid and compact pellet. The results of experiments are cited to justify this recommendation.

NOTES ON A LABORATORY AMALGAMATING DEVICE AND COMPARISONS WITH ACTUAL MILL RESULTS

By H. A. Guess

(Vol. 1, pp. 10.-14.)

In making laboratory amalgamation tests to determine the percentage of saving, agitation of the pulp with mercury, in stoppered bottles, was adopted as the most rapid and satisfac-

tory method. Various motions for this agitation were tested, but none gave entirely satisfactory results. A device was finally adopted by which the bottles were clamped to a small table to which vertical agitation is given by a 2 in. eccentric, run at 350 revolutions per minute. Twenty minutes of agitation was found to be sufficient, but the motion, in practice, was continued for thirty. A method of determining the milling value is described. It enables the handling of small ore shipments at a milling rate otherwise impossible, and is valuable in laboratory mill-tests or for small samples of from pounds to tons, in determining with exactness the saving that can be made in free gold and concentrates, in a properly conducted mill. A table of comparative results of laboratory determinations and mill runs shows laboratory variations of from .9% to (in one instance only) 2.5%.

METALLURGIC STANDARDS

By FREDERICK T. SNYDER

(VOL. II, pp. 3.-12.)

The need of the adoption of standards by which records and results in metallurgical practice may be correctly and intelligently expressed is well illustrated in this paper. The most pressing requirements in this direction are:

1. A unit of weight.
2. A scale of sizes for crushed ore.
3. A coefficient that shall represent the mechanical condition of the ore. Of these, the second exclusively applies to milling operations: the first and third underlie the operation of both milling and smelting.

As a standard of weight the general adoption of the metric ton is urged.

In respect of units of size, for crushed ore, the necessity for definite data led the author to abandon screens entirely as primary standards and to measure the minimum diameter of the ore particles directly by means of a specially constructed micro-

meter. The features of this instrument and of its application are described. It is also shown that once a definite unit of size is available it is possible to arrange a coefficient permitting of legitimate comparison between the work of different mills under different conditions. (Note: Since this paper was written the Institution of Mining and Metallurgy has established a standard of measurement in respect of screens.)

NOTES ON THE OCCURRENCE OF QUICKSILVER IN CANADA

BY A. J. COLQUHOUN

(VOL. II, pp. 13.-16.)

The title of this paper is misleading as the author confines himself to describing the occurrence of cinnabar in the Kamloops district, British Columbia. There are other Canadian occurrences. The formation in which the cinnabar occurs in the region particularized is described as "basaltic and dolomitic dykes traversed by veins of quartz and calcite in which the ore is found in some instances in a pure state, also finely disseminated through the gangue associated with pyrites and other foreign elements." The ore is said to yield from 0.56 per cent. to 2 per cent. mercury. Attempts, however, to mine the deposits in the locality were unprofitable. This is attributed to ignorance and incompetency.

ACROSS THE PITCH VERSUS UP THE PITCH*

BY O. E. S. WHITESIDE

(VOL. II, pp. 17.-20.)

In the Cretaceous measures at Anthracite and Canmore, Alta., the pitch of coal seams varies from 30° to 50°. Sometimes, however, the seam is flat, and again, pitches 90° from the horizontal. In this paper the author compares the methods of win-

* See also Supplementary Paper on this subject, Vol. IV, page 126, summarized on page 28 of this volume.

ning coal from breasts driven across the pitch, nearly in the direction of the strike, and parallel with the gangway, with the same operation in breasts at right angles to the strike, or straight up the pitch, under a few of the conditions that obtain in pitching seams. The conclusions reached are that while there are certain advantages in the "up-the-pitch" method of working, the "across the pitch" system is more economical, and in newer districts where skilled labour is scarce, is certainly to be preferred.

ON THE ESTABLISHMENT OF SCIENCE CLASSES

By A. H. HOLDICH

(VOL. II, pp. 21.-24.)

A plea is here made for the establishment of science classes in the mining centres of British Columbia. The plan on which the arrangements for such instruction should be based is briefly outlined. A concluding note suggests the need of organization among analytical chemists and assayers in British Columbia for mutual protection against unqualified practitioners. (Note: Since this paper was written the British Columbia Government has required assayers to pass an examination before they can practice in the Province.)

A NOTABLE CANADIAN DEPOSIT OF CHROMITE

By J. T. DONALD

(VOL. II, pp. 25.-27.)

The object of this paper is to direct attention to a deposit of chrome ore at D'Israeli, Coleraine Tp., Megantic County, Quebec, from which a considerable production had been made at this date. The deposit was traced by the author for a distance of about 260 feet, and outcroppings appeared at intervals over a breadth of about 60 feet. Representative samples yielded on analysis

from 37.93 to 44.93 per cent. chromic oxide. Concentration tests were satisfactory. In one case ore, assaying 39.50 per cent., tested 48.80 per cent. after concentration. In another case, crude ore assaying 40.50 per cent., tested after concentration 52.60 per cent. chromic oxide.

METALLURGICAL MACHINERY

By A. C. McCallum

(Vol. II, pp. 28.-37.)

This paper has especial reference to the designing of Rolls, Crushers, Stamps and other machines employed in the reduction of ores. The preparation of a graphic diagram of stresses within any machine under design is deemed essential. The subjects of materials, rigidity, weight, vibration and lubrication are discussed.

SWEDISH IRON METALLURGY AND ITS APPLICATION TO CANADA

By James Douglas

(Vol. II, pp. 38.-53.)

The thrifty methods employed for the utilization of Swedish iron ores, are very fully described, and the possibility of their adoption in Canada indicated. Sweden's prosperity is, it is affirmed, in large measure due to the association of three great branches of industry under common management. These are (1) iron and steel making; (2) lumbering and (3) wood pulp manufacturing. The high character of Swedish furnace products is attributed to the use of wood fuel alone. The iron companies own large forest reserves, converting the larger sizes of timber into dimension lumber and wood pulp, the inferior and small timber being used for charcoal making. Profits are also made from the bye-products of the charcoal kiln, while waste such as

saw-dust, shavings, bark, etc., unfit for conversion into charcoal, is gasified in producers of peculiar construction. It is shown that Canada, like Sweden, possesses boundless forests, intricate water-ways, immense water power, pure iron ores and sulphur ores. There are, for example, iron ores accessible to the Ottawa in the treating of which the saw-dust and waste lumber of that river might be used. In short, all conditions are favourable in Canada to the successful application of Swedish methods for the production of iron and steel.

AN IMPROVED METHOD OF INTRODUCING FEEDWATER TO THE STAMP MILL MORTAR*

By BERNARD MACDONALD

(VOL. II, pp. 54.-56.)

It is customary to introduce the water required for this purpose, through iron pipes or rubber hose, over the top of the mortar. The "improved method (illustrated by diagram) provides for feed pipes to introduce the water below or on a level with the crushing surfaces of shoes and dies under a static head. The points of advantages are claimed to be: (1) Increase in crushing capacity; (2) Decrease of sliming; (3) Preparation of the bottom of the mortar to retain and protect the coarse gold from abrasion.

THE IRON INDUSTRY IN 1908

By GEORGE E. DRUMMOND

(VOL. II, pp. 57.-61.)

The author briefly reviews the iron trade of the world for the year, referring in particular to the development of the Canadian industry.

* See also supplementary paper on this subject, Vol. II., pp. 102-104.

MINING IN QUEBEC PROVINCE IN 1898

BY J. OBALSKI

(VOL. II, pp. 62.-65.)

The statistics of Quebec mineral production for the year 1898 is here presented, in commenting on which the author calls special attention to the discovery of nickel and cobalt on Calumet Island, and to finds of molybdenite.

PROSPECTING FOR IRON ORE IN NEWFOUNDLAND AND CAPE BRETON

BY C. A. MEISSNER

(VOL. II, pp. 66.-71.)

The remarkable feature of the Bell Island iron deposits is that the "ore is in regular stratified formation" enabling the miner to calculate the exact tonnage available in a defined area. Commenting on other iron bearing districts in Newfoundland, the author finds that the geological conditions are not dissimilar to those of the Marquette region of Michigan, and considers that the results of prospecting are likely to be uncertain. In Cape Breton, various iron deposits were prospected but, on account of their irregularity, abandoned. The author expresses the opinion, however, that payable deposits may yet be found. It is urged that detailed stratigraphical maps be made of certain areas by the Geological Survey.

WEST KOOTENAY ORE BODIES

BY R. W. BROCK

(VOL. II, pp. 72.-86.)

"Geologically the district is a complex consisting of series of crystalline schists and stratified rocks, dyked, metamorphosed by, and caught up in multifarious eruptives, which in turn treat

each other in like manner. The crystalline and stratified rocks, while united in distribution, include a considerable variety of rocks." The main groups of rocks of the district are described at length, after which particular reference is made to the occurrence of the auriferous iron and copper sulphide deposits of Rossland, and the lead and silver minerals associated with argentiferous tetrahedrite characteristic of the Slocan. Respecting the manner of formation, it is stated that the evidence conclusively indicates the agency of mineralizing solutions, deposition being due to replacement following lines of fissuring and crushed zones. It is pointed out, the ore of higher quality and the largest ore bodies in any particular locality are found in the rocks that are most fractured. Another important relation noticed is that between the deposits and the eruptives. Thus it is stated "districts rich in dykes are rich in ore bodies, and those barren of dykes appear to be barren of ore."

DESCRIPTION OF THE SULTANA QUARTZ LODE, AND THE SINKING OF THE BURLEY SHAFT IN BALD INDIAN BAY, LAKE OF THE WOODS

By J. BURLEY SMITH

(VOL. II, pp. 87.-101.)

The Sultana deposit is described as "composed of huge masses of auriferous quartz, of lenticular shape, interbedded in the Keewatin schists, at or near their contact with the granitoid gneiss." On the assumption of the continuation of the ore-body into the adjoining property, under water, owned by the Burley Gold Mining Company, it was decided to sink a shaft from the bed of the lake. A caisson was therefore built at a distance of about a mile from the proposed site of the shaft, and afterwards towed into position, filled with rock and sunk. The water was then pumped out, and excavation commenced, the ore being encountered at a depth of 140 feet.

AN IMPROVED METHOD OF INTRODUCING FEED WATER TO THE STAMP MILL MOTOR

BY BERNARD MACDONALD

(VOL. II, pp. 102.-104.)

This paper supplements the general information contributed by the author to this volume, under the same title. It describes in detail the equipment for introducing feed water to the stamp mill mortar installed at the Dufferin Gold Mine, Nova Scotia.

THE GOLD BEARING SANDS OF THE VERMILION RIVER

BY J. W. EVANS

(VOL. II, pp. 105.-107.)

Gold in alluvial deposits occurs along the banks of the Vermilion River, District of Nipissing, Ontario. The author notes that the gold is mainly in the first 10 to 12 inches of soil. Samples of sand from the east bank of the river, in Hanmer township, within 20 miles from Sudbury, averaged 60 cents per ton, yielding from one to two hundred colours to a 10-lb. pan. Attempts to recover the gold with a rocker resulted in heavy losses. Conditions are such that sluicing on a large scale would be difficult if not impossible. Gold has also been found in many localities upstream, and the author thinks it probable that valuable deposits containing coarse gold will yet be discovered and considers that many of those already found could be profitably worked.

THE SAMPLING OF ARGENTIFEROUS AND AURIFEROUS COPPER

BY ALBERT R. LEDOUX

(VOL. II, pp. 108.-118.)

The methods employed in sampling argentiferous copper bars are: (1) By boring; (2) by taking dip samples; (3) by sawing. The results obtained by the ordinary methods of

boring are not uniform, since experiments have proved that (1) all gold and silver bearing copper varies in richness at different points; that (2) in general, highly refined material free from arsenic has a concentration of the precious metals along the centre line, the maximum being at the middle point of the bar. The author describes a method of sampling by boring that he regards as perfect. If sawing is adopted, the five bar method is recommended. The method of taking dip samples necessitates many precautions to insure accuracy.

ON THE GOLD MEASURES OF NOVA SCOTIA AND DEEP MINING

BY E. R. FARIBAULT

(VOL. II, pp. 119.-129.)

The workable deposits of free gold are confined to the metamorphic rocks of the Atlantic coast, along which they form a continuous belt for a distance of approximately 260 miles, varying in width from ten to twenty-five miles. The gold measures fall naturally into two well defined and distinct groups, namely, a lower or "quartzite group" and an upper or "slate group." The strata of the former have a supposed thickness of about three miles, and of the latter two miles. The structure of the rocks shows that they have been subjected to powerful and uniform pressure by which they have become folded into a series of huge, sharp undulations, roughly parallel with the sea coast. A comparison is made between the Nova Scotia and Bendigo measures. The amplitude of the folds, or the distance between the different anticlinal axes in Nova Scotia is nearly twenty times greater than in the case of Bendigo. A noteworthy feature disclosed is that all the rich veins and the large bodies of low grade quartz worked in Nova Scotia commonly follow the lines of stratification, and occur at well defined points along the anticlinial axes of the fold. The fact that important mines have been worked at different horizons, from the top of the series to the bottom is sufficient proof, in the author's judgment, that strata favourable to

the formation of auriferous veins are met with throughout the whole thickness of the lower quartzite group and perhaps also in the slate, though apparently less frequently. The paper concludes with a description of operations at a number of mines; and again comparisons are drawn between the quartz veins here and the "saddle reefs" of Bendigo, the author finally expressing the opinion that mining conducted on lines suggested would result in placing the Nova Scotia deposits among the most productive in the world.

TEST OF A TWO STAGE COMPRESSOR

By JOHN PRESTON

(VOL. II, pp. 130.-136.)

This paper records the result of tests on a Rand two-stage compressor, of horizontal type, to determine its thermal efficiency; the action of the compressor valve; and the mechanical efficiency.

NOTES ON THE DRIVING OF SIMPLON TUNNEL, SWISS ALPS

By LEOPOLD MEYER

(VOL. II, pp. 137–142.)

The equipment and planning necessary for the conduct of an undertaking of the magnitude of the Simplon tunnel is here noted. The tunnel, (or rather two parallel tunnels, one of which is for ventilation purposes) is approximately 23,000 metres in length. The contractors agreed to complete the work within five and a half years, under penalty. Compressors of special design were provided, affording pressures at the drills of from 50 to 150 atmospheres, corresponding to 2,700 lbs. per sq. in. For drilling, rotating drills were employed. The quantity of dynamite used was so great that the rock was not only torn asunder, but powdered and almost burnt. The debris was removed by a

stream of water under high pressure. For ventilation, high speed fans, forcing the air from one to another were utilized, while the workings were refrigerated by allowing showers of glacial water to fall at the breast-work after each shot; in addition, the air from the fans passed through coolers.

AN OCCURRENCE OF FREE-MILLING GOLD VEINS IN BRITISH COLUMBIA

By Wm. Hamilton Merritt

(Vol. II, pp. 143-148.)

The occurrence here referred to is that of the Fairview Camp, in the Osoyoos Mining Division. The veins range in width from $2\frac{1}{2}$ feet to 12 and 15 feet, the mineralization being varying proportions of iron pyrites, galena, zinc blende and gold. Mill runs demonstrated the free milling value to be five times that of the value of the concentrate per ton of ore milled. Losses in tailing were, however, considerable. The paper deals more particularly with the geological features of the locality. The occurrences are typical fissure veins in schist, and, occasionally, in granite.

THE ADJUSTMENTS AND CONTROL OF THE STAMP MILL

By Courtenay De Kalb

(Vol. II, pp. 149.-161.)

Ores from mines in the same district, no matter how restricted, are seldom identical in character. These variations should be taken into account. In ordering a stamp mill from the manufacturer, frequently the weight of stamps is not specified. In amalgamating mills, the crushing capacity and the extracting capacity are equally important. The economical line between these two must be determined. Other considerations are the width and depth of the mortar, length of feed hole and

character of automatic feeder, number and positions of inside plates, shape of discharge lip, slope of screen, etc. These requirements, under varying conditions, receive notice. The order of drop of the stamps as influencing the crushing capacity of the mill is discussed and a table illustrating the effects produced by changing from low drop and low discharge to higher drop and higher discharge is included.

GOLD MINING IN NOVA SCOTIA FROM 1860 TO 1899

By A. R. C. SELWYN

(VOL. II, pp. 162.-165.)

The fact that the gold mining industry of Nova Scotia had made no progress in thirty years is here made a subject for comment and analysis. The author offers the following explanations for the condition in question:

(1) Inattention to the recommendations of scientific and practical writers.

(2) The poor system of mining; the hand to mouth policy pursued; the distribution of all proceeds as dividends to shareholders, regardless of the future requirements for mine development.

(3) Non-employment of reliable assayers and metallurgical chemists.

(4) The entire neglect of tailings and pyritous residues.

(5) No systematic attempts to follow up and develop the discoveries of alluvial gold.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES

By F. HILLE

(VOL. II, pp. 166.-185.)

The author describes and discusses the features of the Siemens and Halske percussion and rotary drills.

ON A NEW OR HITHERTO UNRECOGNIZED GEOLOGICAL HORIZON IN THE GAS AND OIL REGION OF WESTERN ONTARIO, CANADA

By Henry M. Ami

(Vol. II, pp. 186.-191.)

The formation or geological horizon in question consists of a series of fine-grained calcareo-argillaceous pyritiferous shales associated with bands of marine fossiliferous limestone which overlie the Portage and Genesee shales of Western Ontario. To this date (1898) the (Devonian) shales of Kettle point on Lake Huron had been recognized as the highest strata in the geological scale of Paleozoic sediments occurring in Western Ontario. The conclusions reached are that (1) The Hamilton formation of Western Ontario extends over a wider area than was at one time expected.

(2) That the Portage and Genesee or Kettle Point shales also extend south from Kettle Point to a point in Bothwell County.

(3) That above the Kettle Point shales there occurs a distinct series of marine beds containing numerous fossil organisms. These beds, with overlying and interstratified shales, constitute the uppermost member of the Devonian system in Ontario.

NOTES ON THE YMIR MINE AND ITS MILL PRACTICE

By S. S. Fowler

(Vol. III, pp. 3.-10.)

The Ymir mine is situated on the west side of a north fork of Wild Horse creek in the Salmon River district, West Kootenay, British Columbia, about 18 miles distant from Nelson. The author describes the physiographical and geological features of the region. The ore body is of lenticular form, with a maximum

width of ore of about 30 feet, the vein filling being quartz, impregnated with pyrite, galena and blende. The ore was apparently deposited at two different periods, or else derived from different sources, for to the east it is a white quartz, while to the west the quartz is dark blue in colour, often nearly opaque, carrying higher values in gold. Other notes on the mine have reference to the structural features of the vein and to the character of the ore produced. The mill is described, and attention directed to special points of practice, notably a provision to overcome a tendency toward banking of the pulp, to correct which the first and fifth stamps are given about $1\frac{1}{2}$ inch greater drop. The extremely small size of the galena particles, together with their gravity, resulted in their catching in the minute depressions of the amalgam and gradually covering it. To keep the plates in proper condition, therefore, they were dressed every six hours.

THE SMALL ECONOMIES IN MINING

By HOWARD WEST

(VOL. III, pp. 11,-20.)

The aim of this paper is to indicate possible directions in which economies may be effected in mining the silver-lead ores of the Slocan district, British Columbia. At the time (1899) only high grade ores could be profitably mined (the average value of the shipments being 103 oz. silver and 46 per cent. lead) consequently there was a tendency to extract only rich ore at the expense of systematic development. This is deprecated. The engagement of qualified, technically trained engineers as mine managers in the place of the merely "practical man" is urged, on the grounds that the latter is incapable of supervising economic details. That low grade ore will not pay to mine in the Slocan is attributed to the "necessarily high cost of transportation and treatment," This condition, it is anticipated, will improve. It is pointed out, however, that by guaranteeing to the smelter the entire output from a mine for a given period and by suiting the ore so far as possible to smelter requirements, by,

for example, eliminating objectionable material, would doubtless result in the securing of especially favourable treatment rates. The subject of economies in relation to concentration is also briefly treated.

THE BRIDGE RIVER GOLD MINING CAMP

By Fritz Cirkel

(Vol. III, pp. 21.-29.)

The Bridge River district is situated 138 miles north-west of the town of Ashroft, B. C. Gold in placers was discovered here in 1858 and mining, on a limited scale, was carried on from year to year. The author after touching on the physiographical and geological features of the district, refers in particular to the gold-bearing quartz veins found there, the majority of which occur in "diorite or in syenite and porphyry near the contact with the former." These veins all strike north-east and although some are miles apart, appear as parrallelisms of straight leads. They possess all the characteristics of fissures, in having very distinct, well-defined and perfect walls. No large faults or displacements are noticeable. The considerable horizontal extension of many of the veins is specially noted and instanced. The results of experiments would indicate that from 40 to 70 per cent. of the gold is free milling, the lower percentage being obtained from ore below the zone of oxidation. Sulphides occur in most of the leads, to the quantity in some cases of 5 per cent. of the ore. The gold values in the sulphides are uniformly high. No definite opinion is expressed concerning the possibilities of profitable mining in the district, the inaccessibility of which, however, is stated as being a drawback.

THE CHICAGO MAIN DRAINAGE CHANNEL

By J. F. Lewis

(Vol. III, pp. 30.-36.)

The Canal, to provide an adequate system of drainage for the city of Chicago, is rather over 28 miles in length, part of which

cuts through solid rock, to a width of 160 feet. The contract was awarded on a basis of 76 3-10 cents for rock work, 28.9 cents for "glacial drift" removal, and 3.27 per cubic yard for retaining wall. The excavation of glacial drift amounted to 28,059,488 cu. yds., and of rock 12,343,416 cu. yds.; while the retaining wall represented 371,969 cu. yds. The cost of machinery and equipment alone was $2,750,000. At times, 8,500 men were employed on the undertaking and the explosives required represented 10,000,000 pounds. The relative efficiencies of dredges, excavators and conveyors of various types used on the work are given, together with a statement of costs.

A METHOD OF COST ACCOUNTING, WITH SPECIAL REFERENCE TO MINES

BY JOHN E. HARDMAN

(VOL. III, pp. 37.-67.)

The author introduces the subject of his paper with the following general statement: "The ultimate work to be done about a mine is the getting of mineral, to effect which is the object of all the organization both of men and materials. Therefore, any system of cost accounts which may be adopted at the mine should show accurately the various items of expenditure which enter into the cost of the production of one unit, whether that unit is an ounce of gold, a pound of base bullion or matte, or a ton of shipping ore. Furthermore, it should enable the manager to know what work is going on, where it is going on, what such work is costing, whether more or less than yesterday, last week, last month or last year, and whether the work is doing at a profit or at a loss; and should enable him to answer these questions at any time by spending a few moments with the cost books." The method of accounting described is based on these considerations. The system is that of single entry. The debit items are few; the credit items are entered under main headings of Labour, Supplies and Expense. In dealing with "Labour," it is essential that the charges should be correctly apportioned. No man's

labour should be lumped, but in the case of labourers not employed on regular work, the time should be charged by the hour and subdivided accordingly. The author further recommends the use of what he terms a "Detail Labour Book," the manner of making entries in which is graphically shown. Summed up, the methods detailed provide a system of recording labour costs, embracing the three necessary factors of (1) keeping full time by the timebooks, (2) aggregating and dividing that time so that correct proportions can be properly charged to the respective accounts by means of the detail labour book, and (3) paying the individual for that labour, by segregating each man's debits and credits on a due bill or pay roll sheet. In respect of supplies it is suggested that the store-keeper either keep a "Stores Received" and "Stores Delivered" book, or make a daily report, on slips, to the office. Other advice is given under this head. To maintain an accurate account of expense, the keeping of a "Cost Minute" book as well as a cost ledger is advocated. In the cost minute book daily entries are made of work done; the labour items from the detail labour book; the supply items from the requisitions sent to the store-keeper and by him returned to the office; the expense items from the regular office books. The author presents very clear and detailed directions for the subdivision of the various items under the general headings and also describes the methods he employed in his own practice for apportioning per unit the costs of management, power, pumping, and hoisting. At the end of each month the accounts from the cost minute book are posted in the cost ledger. Attention is directed, in conclusion, to cost analysis methods as practiced by several of the important South African mining companies.

NATURAL GAS IN ONTARIO

By EUGENE COSTE

(VOL. III, pp. 68.-89.)

The first drilling for natural gas was undertaken in the year 1888, under the direction of the author near Ruthven, in the county of Essex, Ontario. Gas was struck at a depth of 1020

feet, in a dolomitic limestone forming the upper bed of the Guelph formation, and led to the development of the Essex county gas-field. Shortly thereafter gas was encountered at 836 feet in sandstone of the Medina formation in Welland county, which has since become a widely productive area. The author describes the geology of these fields, presenting therewith the logs of many of the wells drilled in both Essex and Welland counties. From this information, many important facts were deduced and are enumerated in support of the author's theory concerning the inorganic origin of natural gas and petroleum.

A PROSPECTING TRIP IN NORTHERN OMENICA, B. C.

By E. C. MUSGRAVE

(VOL. III, pp. 90.-96.)

An account is here given of a journey to the Omenica district, by water from Victoria, B. C., the purpose of which was to examine an occurrence of gold-bearing conglomerate at Bear Lake. Samples were taken and assayed, yielding results of values ranging from 50 cents to $12.50 per ton.

NOTES ON ATLIN GOLD FIELDS

By J. C. GWILLIM

(VOL. III, pp. 97.-101.)

Placer gold was discovered in the Atlin Mining Division, of British Columbia, in the summer of 1898. Operations, at the time this paper was written, were concentrated on seven short streams, at points not far from bed-rock. The total producing length of the creeks referred to is estimated to be from 12 to 14 miles, the aggregate length of the streams being from 50 to 60 miles. In the summer of 1899 the gold production was (prob-

ably), $750,000. The gold is usually coarse, often in flat flakes, ranging in size from that of flax seed to nuggets weighing half an ounce. Nuggets, usually well rounded, are not uncommon. The pay gravel is commonly found at or near bedrock. Quartz veins, in fissures, also occur in the district. Reference is also made in the paper to the climatic conditions, topographical features and timber resources.

THE FACTORS IN CONCENTRATION

By F. T. SNYDER

(VOL. III, pp. 102.-109.)

The conclusions demonstrated are that each concentration problem must be solved twice; first, backward from general factors to details; then forward with settled details to a definite general result. Starting with the general transportation and refining factors, the limits are found between which concentration is possible at any geographical point. Next the physical conditions of the problem under consideration determine the types of crushing and concentration machinery and capacity of plant. Lastly, the values in the ore determines the investment; that is, the number of machines of each type to be used per ton capacity desired. Then with these definite quantities applied to the general factors, the solution is retraced and a definite showing decides whether the return minus the costs will have a positive value.

THE ONTARIO MINING LAW

By J. M. CLARK

(VOL. III, pp. 110.-117.)

The paper contains a brief history of mining legislation in Ontario, together with an exposition and comment on the provisions of the Mines Act, 1897.

THE IRON INDUSTRY IN 1899

By GEORGE E. DRUMMOND

(VOL. III, pp. 118.-123.)

The author reviews the iron trade of the world of the year 1899, and notes, in particular, the improvement in Canadian conditions, attributable in large measure to the settlement of the question of the iron duties and bounties "upon something like a permanent basis."

THE OLD VALLEY GRAVELS OF THE KLONDIKE

By R. G. MCCONNELL

(VOL. III, pp. 124.-127.) 1900

The gold-bearing gravels of the Klondike are capable of classification under three heads, namely, the stream gravels, the bench gravels, and the ancient gravels, the nature and origin of which is made the subject of the present paper. The valleys of the principal producing creeks are bordered usually on one side, occasionally on both sides, by wide benches, owing their origin to a former sudden rise in the general elevation of the country, in consequence of which, the grade and cutting power of the streams were increased and thus the channels were sunk or deepened some hundreds of feet below the old level. The portions of the ancient valley bottoms not destroyed during the process of sinking, or by subsequent erosion, constitute the benches in question. These benches vary in width from a few hundred feet to half a mile or over. The gravels resting on the benches consist of a deposit known as the quartz drift, deposited on bed rock, and an upper layer of flat, rusty-coloured gravels resembling those in the existing valleys, but much more thickly deposited. The quartz drift consists essentially of a compact mixture of fine quartz grains, scales of sericite, boulders of quartz, and less frequently of greyish mica schist. The drift varies in thickness from a few feet to 120 feet and in width from 100 yards to half a mile or over, and is everywhere more or less gold-bearing. The upper gravels, however, had not proved remunerative. The author is unable to express a definite

opinion concerning the origin of this peculiar deposit, for although it bears some resemblance to a glacial deposit there is no evidence of ice action either on the boulders or on the surface of the bedrock.

RESULTS IN THE USE OF A ROTARY PUMP AS AGAINST STRAIGHT LINE TYPE

By CHARLES FERGIE

(VOL. III, pp. 128.-129.)

The results of practical tests of the relative efficiencies of the rotary and of the direct acting straight line mine pumps are here presented, the superiority of the former being clearly demonstrated.

NOTES ON INCREASED FACILITIES AT WABANA IRON MINES

By R. E. CHAMBERS

(VOL. III, pp. 130.-132.)

The author describes the equipment and plant provided at this mine in the year 1900. The paper is accompanied by four plans of the mine; the original haulage plant, the new haulage plant, and the new pier, respectively.

RECENT ADVANCES IN ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY

By W. L. GOODWIN

(VOL. III, pp. 132.-140.)

In the first section of the paper the history of current electricity is concisely reviewed. The second section deals with the development of electro-chemistry and of electro-chemical industry, the total annual production of which at the time is quoted as representing a value of $150,000,000. The author

discusses the outlook in Canada for the development of such industries, emphasizing in particular the enormous potentialities in the utilization of Canadian water-power to this end. He concludes thus: "The competition between water power and steam power is extending, and perhaps at no very distant date, Canada, with her unlimited water power, and her great variety of raw materials, will take her place as the chief manufacturing country of the world."

WEST KOOTENAY NOTES

By R. W. BROCK

(VOL. III, pp. 141.-144.)

These notes supplement the paper contributed by the author to the Institute in 1899 (West Kootenay Ore Bodies, Vol. II, pp. 72-86), and are confirmatory of the conclusions there expressed, especially in respect of the genetic relationship between the "white dykes" or light-coloured porphyries and the ore bodies.

The paper also contains some advice to prospectors on the subject of the development of mineral claims.

MINING PUMPS

By C. E. MORGAN

(VOL. III, pp. 145.-148.)

The author gives general advice, of a rather elementary character, on the types of pumps suitable for mine purposes.

ARE THERE DIAMONDS IN ONTARIO?

By ARCHIBALD BLUE

(VOL. III, pp. 149.-160.)

The author combats the theory of Prof. W. H. Hobbs and other eminent geologists that the glacial drift, containing dia-

monds, of the moraines of Ohio, Michigan and Wisconsin, originated from localities in the region of Hudson Bay. He states: "The fact is obvious that glacial drift is not in the mass borne very long distances and it would require good evidence to sustain the opinion of Professor Hobbs that the moraines..... are constructed out of materials carried upon ice or shoved forward by it a distance of 700 miles from the tableland of Ungava." The localities in Ontario in which it is suggested diamonds may be found are the Rainy Lake and the north shore of Lake Superior, in the vicinity of Thunder Cape, "where there is a thickness of not less than 1,000 feet of Animikie slate, cut through by numerous dykes of diorite with intrusive sheets of the same material which Lawson has shown to be laccolite sills." An analysis of slate occurring in the Keewatin yielded 7.44 per cent. of carbon.

NOTES ON GOLD MILLING PRACTICE AT THE ATHABASCA MINE, NELSON, B. C.

BY E. NELSON FELL

(VOL. IV, pp. 83.-90.)

The ore at the Athabasca Mine is a hard, bluish quartz, containing a large proportion of sulphides of zinc, lead and iron, showing free gold only when the grade is of $30 and over; and then usually, in intimate association with the lead and zinc sulphides. An analysis of the ore showed:

Gold	1.35 oz. per ton
Silver	.45 " " "
Zinc	2.20 per cent.
Lead	1.60 " "
Iron	10.70 " "
Sulphur	6.00 " "
Silica	68.80 " "
Lime	1.90 " "
Alumina	6.00 " "

A peculiar feature of the ore, and one that probably assists recovery in the mill, is the free gold that is found imbedded in the zinc and lead sulphides. The milling practice is based on the

theory that the gold should be given as early and as ample an opportunity to amalgamate as possible, and hence the use of large plates inside the mortars. Again, in order to preserve the back plate intact, the weight of the chock block carrying the front inside plate is not altered, and thus the level of discharge is always the same. There is, moreover, little tendency of the plates to scour, and the change of screens (50-mesh is employed when the dies are new, 40-mesh after 30 days wear, and 30-mesh when the wear is extreme) offsets the increasing weight of discharge consequent on the wear of the dies. The recovery varied from 77.6 to 81 per cent., the losses, it is believed, being mainly in the sulphides.

NOTES ON THE MAGNETIC IRON SAND OF THE NORTH SHORE OF THE ST. LAWRENCE

By J. OBALSKI

(VOL. IV, pp. 91.-98.)

For some years, from 1867 to 1875, the iron sands at Moisie were the basis of an industry. The iron was smelted in local furnaces and the product marketed in Montreal and in the United States. The abandonment of the enterprise is attributed to the ruling of the American Customs authorities, whereby the iron was classified as bar and subjected to a prohibitive duty. The principal occurrences noted are those of Moisie, Natashquan and St. Jean River. At Natashquan, the author states, the sands are distributed in layers of varying thickness for a distance of twenty miles, and he estimates would yield over a million and a half tons of 60 to 70 per cent. iron ore to the mile. The deposits, it is considered, could only be worked successfully on a large scale. Analyses of the sands from official and other sources, are quoted.

A SIMPLE AND CONVENIENT INSTRUMENT FOR MINE SURVEYS

By Frank Robbins

(Vol. IV, pp. 99.-106.)

In cases where there is neither time nor occasion for an accurate survey, but what is required is something more than a sketch and something less than a finished plan, the author recommends the use of a pocket compass of special design, made by Gurley, of Troy, N. Y., attached to a light tripod. The only difficulty that presented itself was that of a suitable attachment to permit of the taking of readings in the vertical. This was overcome by employing an universal joint, a description and diagram of which is given.

ROPE DRIVEN VERSUS DIRECT DRIVEN COLLIERY VENTILATING FANS

By Francis T. Peacock

(Vol. IV, pp. 107.-112.)

The conditions to be considered in determining whether a colliery ventilating fan should be coupled to the engine direct, or driven through the medium of a belt, or cotton or hemp ropes, are here enumerated. The direct driven fan has an advantage in respect of low first cost, but as the author shows, has numerous disadvantages for large installations. Belted fans are stated to be objectionable, except for very small capacities or temporary installations. For all important undertakings, the rope-driven fan is strongly recommended and its superiority in numerous respects is indicated.

TREATMENT OF AURIFEROUS MISPICKEL ORES

BY P. KIRKEGAARD

(VOL. IV, pp. 113.-122.)

The treatment of the ores of the Deloro Mine, Ontario, consisting of quartz more or less heavily impregnated with arsenopyrite, with occasional copper-pyrites and frequently iron sulphide in large amount, is here described. The ores which are worked for their gold and arsenic contents, are first subjected to amalgamation in a 20-stamp mill, the saving from which averages 57% of the assay value. This is followed by concentration and treatment by the bromo-cyanide process. After the extraction of their gold contents, the concentrate is calcined for arsenic recovery. The crude arsenic is refined, the product being white arsenic (arsenious oxide), analysing from 99.4 to 100 per cent. As_2O_3. The particular features of the treatment and departures from ordinary milling practice are specifically detailed.

LEACHING COPPER ORES BY SULPHUROUS ACID

BY E. P. JENNINGS

(VOL. IV, pp. 123.-125.)

This process is said to possess certain valuable features, and to be peculiarly suitable for the treatment of copper ores in localities remote from transportation, fuel and fluxes. Native oxides and carbonates of copper are readily soluble in sulphurous acid, forming cuprous sulphite. This salt is insoluble in water, but soluble in water containing sulphurous acid from which the copper can be precipitated by driving off the excess of sulphurous acid by heat. The precipitate is cupro-cuprous sulphite and contains 49.1% of copper. This salt is a heavy, crystalline compound of a dark red colour, which settles readily from the solution and can be washed by decantation, dried and reduced to metallic copper by fusing on the hearth of a reverberatory furnace.

ACROSS THE PITCH VERSUS UP THE PITCH

By O. E. S. WHITESIDE

(VOL. IV, pp. 126.-130.)

This is a continuation of a paper bearing the same title contributed by the author to the Institute in the year 1899. (Vol. II, pp. 17-20.) Corroborative of the conclusion there reached, the author considers that "across the pitch" methods are preferable in seams containing refuse in any quantity necessitating cobbing within the mine; while "up the pitch" offers advantages in mining seams in which there is little or no refuse, or where all the seam material is taken to the surface, and especially in cases where the seam is thin. To this general rule, however, there are exceptions. If it be essential that the pillars be left, a tolerably dirty seam might better, possibly, be worked "up the pitch;" on the other hand, if miners skilled in work of this character cannot be obtained, it would then be necessary to work a very clean seam, even though it be a thin one, "across the pitch." Methods of mining pitching seams in Belgium and the coal fields of the States of Pennsylvannia and of Washington are also discussed.

SHIPPING COAL BY THE AERIAL WIRE ROPE SYSTEM AT PORT MORIEN, CAPE BRETON

By JOSEPH G. S. HUDSON

(VOL. IV, pp, 131.-134.)

The installation is described and the handling of coal by this method is stated to have proved eminently satisfactory.

COAL, GAS, AND COKE AS DOMESTIC FUELS

By F. H. MASON

(VOL. IV, pp. 135.-142.)

It is urged that fuels, especially coke, be sold on its analysis, and further that vendors should be required to give a guarantee that the fuel is within reasonable limits of the analysis. The

calorific powers of the respective fuels enumerated are then considered. It is shown that since a ton of bituminous coal, costing $4, is capable of producing from ten to eleven thousand cubic feet of gas, costing $1 per 1,000 feet, and six-tenths to seven-tenths of a ton of coke, costing $3.50, that where a continuous fire is desired, gas is not an economical fuel. For furnace purposes, whether for heating by hot air, hot water or steam, the writer advances the opinion that coke will compare favourably, both as regards economy and effectiveness, with any other form of fuel.

THE TREATMENT OF AURIFEROUS MISPICKEL ORES AT DELORO, ONTARIO

BY SIDNEY B. WRIGHT

(VOL. IV, pp. 143.-151.)

The information presented in this paper supplements that contributed by Mr. P. Kirkegaard (Vol. IV, pp. 113-122). A more detailed reference is made to the chemistry of the process adopted for the treatment of the concentrate. The chemical consumptions and extraction on the concentrate, in conjunction with the saving effected by amalgamation, are represented to be:

Potass. Cyanide, per ton of concentrate treated ..... 2.0 lb.
Cyanogen Bromide, per ton of concentrate treated ... 0.5 lb.
Zinc Fume, " " " " " ... 0.19 lb.
Total length of treatment.....80 to 100 hours.....
Extraction of gold from concentrate . . 87 per cent to 94 per cent.
An average of.....90.5 per cent.....

This latter with the values saved by amalgamation represents a total recovery of from 88 to 90 per cent. of the original gold contents of the milling ore, which, considering its refractory nature, the author regards as being eminently satisfactory.

THE COMPOSITION OF SOME CANADIAN LIMESTONES

By J. T. DONALD

(VOL. IV, pp. 152.-154.)

The ideal limestone is pure calcium carbonate containing 56 per cent. of lime and 44 per cent. of carbon dioxide.

The author's aim is to indicate generally the characters or properties of limestone rendering them suitable in the manufacture of respectively calcium carbide, chemical wood pulp, and Portland cement. Thus it is shown that for calcium carbide manufacture, the presence of magnesia is particularly detrimental; though a small percentage of siliceous matter and a little iron oxide may be tolerated. For sulphite pulp the presence of magnesia is most desirable, while that of iron is decidedly objectionable. For cement making, a somewhat wide range of material is advisable; but magnesia is debarred, to the extent that the finished cement must contain less than 3 per cent. of this substance.

THE COAL CREEK COLLIERY OF THE CROW'S NEST PASS COAL CO.

By C. V. CORLESS, Student.

(VOL. IV, pp. 155.-173.)

The author gives a detailed description of these mines, their equipment, method of working in force at the time, the geology of the area, together with much general information relative to the subject on which the thesis is based.

ALGOMA MINING FREAKS

By CHARLES BRENT

(VOL. IV, pp. 174-179.)

Several amusing stories are here related to typify the ignorance displayed by men in charge of certain mining undertakings in Ontario many years ago. Of these, the following narrative is a tolerably representative one: "I was engaged as assayer,

some years ago, by a Canadian company who were operating on the north shore of Lake Superior. The manager, a school teacher of years and experience, was driving a tunnel into a granite hill. The tunnel was lower at the breast than at the mouth, and as one only was worked, there was an accumulation of several feet of water during the night. I have a very vivid impression of all hands and the cook packing water out of that tunnel every morning. I ventured to suggest a hand pump.... After a lapse of several days the manager announced that he had sent for a pump and that it would arrive at the station that evening. I was ordered to go for it.... I went off, full of anticipation which was more than satisfied when I saw the pump. It was a good sized syringe, intended for spraying fruit trees" etc., etc.

In concluding the author protests against "the dishonesty and incompetence that have been the cause of so many failures in mining in our country."

THE ANALYSIS OF CORUNDUM AND CORUNDUM ROCK

By W. L. Goodwin

(Vol. IV, pp. 180.-183.)

The three methods for the determination of corundum are, namely, (1) The hydrofluoric method, and (2) The specific gravity method; while the third, separation by heavy solution, is only approximate. The first method is described in detail.

NOTES ON THE OREGON NICKEL PROSPECTS

By A. R. Ledoux

(Vol. IV, pp. 184.-189.)

These deposits occur on Big Piney Mountain, in Douglas County, Oregon, some 235 miles south of Portland. The ores belong to the same type, and in appearance and occurrence resemble closely those of New Caledonia. After a brief reference

to the geological relationships, the extent of the deposit, and the values in the ore,—which are represented as ranging from 1.23 to 9 per cent. nickel, the great mass of the mountain being low grade—the author discusses possible methods of utilization. In closing he advances the opinion that some of the nickel deposits of the United States need only the stimulus of an export duty on Canadian nickel to be turned to productive account.

THE DUTY OF STAMP MILLS IN CRUSHING AND AMALGAMATION

By COURTENAY DE KALB

(VOL. IV, pp. 190.-195.)

It is frankly stated that no more has been intended in this paper than to throw out a few suggestions on important points, without any pretense of adding new knowledge, and there is no attempt to lay down any rules concerning the duty of stamp mills. The guide for the millman is to study his pulp often and critically, that he may know and not guess when he has obtained the combination of highest crushing capacity with the highest amalgamable capacity, adjusted to the line of the highest economical results.

NOTES ON THE IRON ORE DEPOSITS OF BILBAO, NORTHERN SPAIN

By FRANK D. ADAMS

(VOL. IV, pp. 196.-204.)

The Iberian peninsula is known to contain many large deposits of iron ore, some of which have been worked from very early times. Iron occurs throughout the whole length of the Cantabrian mountains on the northern coast of Spain, in Navarre, through the Basque Provinces, to northern Portugal. The most extensively worked deposits are those in the district

of Vizcaya, and known as the Bilbao iron deposits. Their mode of occurrence, origin extent and composition are discussed. The ores are of five classes, namely (1) red hematite; compact, soft or sometimes powdery, holding about 64 per cent. of iron; (2) Red hematite; compact and crystalline, with numerous little drusy cavities lined with calcite, and said to carry about 55 to 58 per cent. of iron with from 4 to 8 per cent. of lime; (3) Limonite, carrying about 55 per cent. of iron, but usually more or less silicious; (4) a ferruginous clay, with limonite nodules; (5) Siderite, carrying about 44 per cent. of iron.

NOTES ON CRUSHING AND SIZING IN THE ORE-DRESSING LABORATORIES OF McGILL UNIVERSITY

By J. Bonsall Porter

(Vol. IV, pp. 205.-223.)

The author records and tabulates the results of a series of tests, employing crushing devices of several makes and types, to determine the percentage of fines in each instance, in the crushing of ores of varying crushing qualities and economic importance, such as magnetite, calcite containing galena, blende, etc., pyrrhotite, gold quartz, coal, and limestone.

DETERMINATION OF LEAD IN ORES BY FIRE ASSAY

By Douglas Lay

(Vol. IV, pp. 224.-229.)

In many institutions for the instruction of assaying it is customary to start the beginner with dry lead ores, the prevalent idea being apparently that it is a somewhat elementary task, whereas, as the author states, all practice tends to point to the

fact that the successful conduct of that operation requires considerable experience, and that it is in reality one of the most difficult of the fire-assays. The paper is therefore devoted to indicating the difficulties likely to be encountered; and the sources of error and the means to be followed for the insurance of accuracy. Errors, it is shown, may arise from: 1. *Loss of lead* due to (a) Volatilization; (b) Lead passing into the slag in chemical combination; (c) Spirting causing mechanical loss. 2. *The presence of certain elements in the ore*, which under the conditions of the assay are also reducible, and pass into the button of lead simulating that metal.

The author concludes with the remark that lead determination by fire assay is unsatisfactory, inasmuch as while the errors involved may be reduced to a minimum, their total elimination is impossible, adding: "It would seem then that these facts argue strongly for the speedy and general adoption of the wet method (with a certain arbitrary deduction) as a basis for settlement in the case of the buying and selling of lead ores, as is the custom with copper ores to-day."

PIONEER WORK IN THE CROW'S NEST COAL AREA

WM. BLAKEMORE

(VOL. IV, pp. 230.-243.)

The economic importance of the Crow's Nest Coal area was first recognized by the late Dr. G. M. Dawson; the coal was discovered by Mr. William Fernie, after whom the mines are called. The coal seams are found in the lower Cretaceous formation, and are interstratified principally with sandstone and shales, superimposed upon Carboniferous limestone. The area of workable coal is stated to be 150 square miles, each square mile of which was computed by Dr. A. R. C. Selwyn to represent 24,976,000 tons of available coal. The coal measures lie in a long and narrow synclinal trough, the strike being due north and south. Mining operations were commenced at Coal Creek in November, 1907.

The initial difficulties, chiefly due to the then relative inaccessibility of the field, are briefly enumerated. Special attention is directed to the excellent quality of the coke made from these coals, which is shown, by comparative analysis, to be at least equal to the finest Welsh product, and since it was sold at less than one half the price of the imported cokes, it exerted an important effect towards lowering smelting costs in British Columbia. The paper concludes with a description of the appliances, plant and machinery installed at Coal Creek at this period.

COMPANY LAW

By J. M. CLARK

(VOL. IV, pp. 244.-253.)

The author reviews the history of legislation in Great Britain for the regulation of joint stock companies, an interesting fact in this connection being that the principle of limited liability was not recognized until 1855, not much over half a century ago. The report of a committee appointed in 1894 by the British Board of Trade "to enquire what amendments were necessary in the Acts relating to joint stock companies incorporated with limited liability" is here quoted, and comment made thereon.

CONCENTRATION OF ARGENTIFEROUS GALENA AS CARRIED ON AT HELENA FRISCO CONSOLIDATED COMPANY'S MILLS, IDAHO, U. S. A.

By W. MUIR EDWARDS, Student.

(VOL. IV, pp. 254.-264.)

The description here given, although referring in particular to practice at one mine, has general application, with minor exceptions, to silver-lead concentration methods in the Cœur d'Alene district, of Idaho. The paper also compares practice in the Cœur d'Alene district with German practice in the treatment of similar ores at Clausthal in the Harz mountains, and notes the superiority of the former.

THE IRON ORE FIELDS OF ONTARIO

By Willet G. Miller

(Vol. IV, pp. 265.-283.)

Iron manufacturing in Ontario dates from 1800, when chiefly in Norfolk County, near Lake Erie, the industry was carried on until about 1855. A second industrial period followed the first, marked by the beginning of iron export across Lake Ontario into the United States, after the furnaces in the Province had ceased operation. The iron ores of the Province include: (1) Bog ore, (2) Magnetite, (3) Titaniferous Magnetite and (4) Hematite. The author disregarding bog ore as being no longer of economic importance, shows that the Ontario ore fields are geographically and geologically divisible into two distinct regions,—those of, respectively, south-eastern and of northern and north-western Ontario. The south-eastern region contains ores of economic value, magnetite and hematite occurring prevailingly, in the Grenville series, whereas those of the north and west are found in the Huronian. The most striking characteristic of the iron ranges in the newer field is the occurrence in them of bands of jasper or other closely related silicious material, usually as layers a few inches in breadth, interbanded with iron ore which is in some cases hematite; in others magnetite. These respective areas are described in detail, while reference is also made to the occurrences, and possible future economic value of the titaniferous magnetite deposits, which are found in numerous localities throughout the Province.

NOTES ON SOME WORK RECENTLY DONE IN THE MINING LABORATORIES OF McGILL UNIVERSITY

By J. Bonsall Porter

(Vol. V, pp. 3.-9.)

The paper contains an exposition of the author's methods of teaching ore-dressing and kindred subjects at McGill University, at which he occupies the Chair of Mining.

THE DRY ORES OF THE SLOCAN, B. C.

By R. C. CAMPBELL-JOHNSTON

(VOL. V, pp. 10.-14.)

For the purposes of this paper a "dry" ore is defined as one containing not over 10 per cent. of metallic lead to the ton. The "dry ores" of the Slocan are invariably rich in silver, and occasionally carry gold. The area in which they occur, and to which reference is here made, is bounded on the north by the divide between the Lardeau and Slocan districts, stretching from Kootenay Lake to Arrowhead; on the east by Kootenay Lake; on the south by Kootenay river, and on the west by the Arrowhead lakes and the Columbia river. The ore is stated to occur in veins, of which there are at least four series, the values being usually found in pay streaks, while the mass would probably yield $12 or over in gold and silver. Another type of ore carries high silver but no gold values. In the case of the gold-silver ores, the gold is not free. The silver is at times associated with galena, zinc-blende, etc., at others, occurs as native, and occasionally as a chloride. By reason of the high transportation and treatment costs, the economic conditions obtaining in the district at this date (1902) are shown to be unfavourable.

NOTES TO ACCOMPANY ONE PLAN AND THREE VERTICAL SECTIONS OF THE ATHABASCA MINE, ON TOAD MOUNTAIN, NEAR NELSON, BRITISH COLUMBIA

By E. NELSON FELL

(VOL. V, pp. 15.-20.)

The vein at the Athabasca mine cuts a contact between a schistose eruptive rock and a more recent granite. The vein is remarkably well defined, is very continuous, is broken by innumerable faults, and passes from the schist into the granite without any interruption, although the values in the latter are less. The geological conditions and the methods employed in the development of the mine are graphically explained in the plans accompanying the paper.

CHARACTERISTICS OF THE ATLIN GOLD FIELD

By J. C. GWILLIM

(VOL. V, pp. 21.-32.)

The two more important streams in the Atlin District are Pine and Spruce Creeks, both of which flow, in sharply cut gutters, through the general level of the broad valley bottoms. The valleys are floored with serpentinized rocks and diorite and diabase, the inequalities of the outcrops being hidden in a major degree by terrace deposits. The streams have cut through superficial deposits of clay, boulders, gravel and sand, composed of the local rock materials. This material is in places false bedded gravel and sand; at others a stiff grey boulder clay containing striated boulders. Beneath the drift, and at about the level of the present stream bed, are large deposits of yellow gravel, representing a stream bed older than the drift deposit which now overlies it. The gold contents of these pre-glacial streams are concentrations from the wearing away of the pre-glacial valley. The post-glacial streams cut for themselves new channels through the drift; and any temporary stream bed would concentrate more or less placer gold from the drift of which it disposed. The gold in some of the dry or nearly dry runs is thus explained. Concerning the origin of the placer gold in the Atlin district, the author states that its source from any great vein or system of veins is unlikely, but "rather that the different varieties of county rock.... are gold bearing either in themselves or in the various forms of dykes, veins, and stringers or segregations of secondary material."

ON WIRE ROPES

By W. D. L. HARDIE

(VOL. V, pp. 33.-41.)

The information contained in this paper is intended to benefit "the younger members of the profession," but it nevertheless includes much data, particularly in regard to the testing of rope, of value to engineers generally.

THE ANALYSIS OF INSOLUBLES

BY DOUGLAS LAY

(VOL. V, pp. 42-46.)

The author describes methods for the determination of (1) Silica in ores containing barium sulphate; (2) Silica and iron in titaniferous iron ores, and (3) Iron and chromium in chromite.

NOTES ON THE LIMESTONE OF THE PHILIPSBURG RAILWAY AND COAL COMPANY

BY J. T. DONALD

(VOL. V, pp. 47-48.)

This property covers 315 acres on the outskirts of the village of Philipsburg, Que., and is a series of beds of limestone, some of which is of very high quality, as is shown by analysis. It is eminently suitable for calcium carbide manufacture.

THE IRON ORE DEPOSITS OF WESTERN ONTARIO AND THEIR GENESIS

BY F. HILLE

(VOL. V, pp. 49-61.)

The Western Ontario iron deposits are here classified under:

1. Huronian: Magnetites and limonites from carbonates.
2. Post Huronian: Magnetites.
3. Cambrian: Magnetites and carbonates, etc.

The localities in which they occur are:

Class 1. The Kaministiquia; the Mattawin; Greenwater Lake; Hunter's Island and Atikokan.

Class 2. Green Water Lake and Head Lake.

Class 3. Magnetites at the northern margin of the formation. The origin of Class 1 is attributed to "the interior action of an eruptive granite or gneiss whose fumarolic activity must have been not only very intense, but also of considerable duration. Then the exhalated minerals coming in contact with underground water furnished not only the contents of these iron deposits directly, but leached also a large portion of the iron from the schist and deposited it into the fissures."

The origin of the ores of Class 2 is ascribed to magmatic differentiation, while the Class 3 deposits are said to be "an oxidation product."

Accompanying the paper are maps explanatory of the author's views.

OCCURRENCE OF DIAMONDS IN SOUTH AFRICA, WITH THE METHODS OF THEIR EXTRACTION AS ADOPTED AT THE DE BEERS DIAMOND MINES

By L. J. Abrahams

(Vol. V, pp. 62-75.)

Diamonds are found in localities in South Africa in river diggings, from the surface down to a depth of 10 feet in the river gravel, consisting of quartz, chert and jasper pebbles, together with agates.

In the mines they occur without exception in pipes of volcanic origin. The matrix (blue-ground) consists of a breccia containing basalt, diorite, sandstone cemented with decomposed olivine, magnetite, bronzite, garnets, etc. From the surface to a depth of about 150 feet the ground is oxidized and is yellow.

The river gravels are washed in wooden rockers, while the blue-ground from the mines is hauled to "depositing floors" and exposed to the atmosphere for periods varying from 6 to 18 months. The disintegrated ground is then put through washing machines, which are fully described. The concentrate is sent to a pulsator, (a system of jigs), the product from which is sorted by machinery. Ground that will not weather is crushed and sized and then subjected to the same treatment.

THE IRON ORE DEPOSITS NEAR KITCHENER, B.C.

BY W. BLAKEMORE

(VOL. V, pp. 76-80.)

These deposits consist of a series of parallel veins of hematite ore described as "running continuously for a distance of ten miles, and situate, at the nearest point, a distance of three miles west of Kitchener Station on the Crow's Nest Pass Railway." The occurrence is in a large body of quartzite approximately 500 feet in width. Five veins were prospected, the aggregate thickness of which is stated to be 63 feet. The result of over a hundred assays showed the ore to average 60 per cent. of metallic iron, 5 per cent. silica, .10 sulphur, and .03 phosphorous.

There is a present use for the iron as a flux, but the author believes that eventually it will become the source of supply for extensive iron and steel manufacturing, all the conditions being favourable for the establishment of a local industry.

ON THE COPPER-BEARING VOLCANIC ROCKS IN THE EASTERN TOWNSHIPS OF THE PROVINCE OF QUEBEC

BY JOHN A. DRESSER

(VOL. V, pp. 81-86.)

The copper-bearing rocks of the Eastern Townships comprise three principal belts. The most westerly of these is an extensive band of limestone, sometimes associated with black slates or graphitic shales. In it are the deposits of the Acton Mine, Upton, Roxton, Wickham and St. Flavien. In the central or Sutton belt, the country rock was found by the author to be disguised volcanics of early geological age and much altered in character. The deposits include the Harvey Hill at Leeds, the Halifax in Halifax township, the Viger in Chester, the St. Francis in Cleveland, the Balrath in Melbourne and Sweet's mine in Sutton. Copper is found not in true veins, but in lenticular masses, the ore being a secondary derivation from the country rock.

A FEW NOTES UPON GOLD DREDGING

By F. Satchell Clarke

(Vol. V, pp. 87-103.)

The causes of the non-success of gold-dredging operations in British Columbia are discussed and attributed to inexpert management and the use of dredges of an unsuitable type. The author expresses the belief that gold dredging under proper auspices would become a profitable industry in British Columbia.

COAL MINING IN THE NORTH-WEST TERRITORIES AND ITS PROBABLE FUTURE

By Frank B. Smith

(Vol. V, pp. 104-112.)

The area of Alberta, Assiniboia and Saskatchewan, at the time this paper was written, constituting the organized district of the North-West Territories, is represented as being about 304,-340 square miles. Concerning which the author remarks "there is no point on this immense area that is more than sixty miles from a coal-bearing belt, either developed or lying dormant."

The character and quality of the coals found in, and the geological and physiographical features of, the territory receive attention, while a brief account is also given of coal mining there in progress. The author concludes: "To attempt to estimate the quantity of available coal in the Territories would be to attempt the impossible, but from what we know of the natural exposures and what has been proved, will ensure for us centuries of consumption and a surplus for exportation which will make of the North-West a province second only as a coal producer to the State of Pennsylvania."

THE NATIONAL IMPORTANCE OF MINING

By JOHN E. HARDMAN

(VOL. V, pp. 113-125.)

After demonstrating the importance of the mineral industry in its relation to national prosperity, the directions are indicated in which government may legitimately and should advisedly render assistance in the promotion of mineral development. It is premised that in the administration of a government mining bureau or geological survey, politics should not be allowed to enter. The functions of such a service are then considered and the necessity for the provision of accurate maps, for the prompt publication of statistics, and for the practical application of geological investigation to the development of the mineral resources of a country, are emphasized. At the same time it is pointed out that it is not the business of government to concern itself with commercial questions, but rather "do for the mining industry, as a whole, what the unaided individual engineer or mine owner cannot do. That it should never undertake what can just as well be done by the individual engineer or owner . . . . nor should it in any way enter into competition with professional men."

The idea of establishing a Bureau of Mines, as distinct from the Geological Survey is deprecated on the grounds that "any two such Bureaus would of necessity overlap each other, causing a waste of funds and time if they were not connected and under one jurisdiction". It is further stipulated that "all geologic work must be free from local or provincial considerations, and must depend upon the importance of the problems to be solved, and of the best methods of solving them." The publication of a series of monographs on the important minerals of Canada, covering such questions as mode of occurrence, origin, association, the methods of mining, sorting, smelting, refining and marketing the product, is also urged. In the discussion following this paper other means for the encouragement of the mining industry by Government are proposed and considered. These include favourable legislation, the inspection of mines, the establishment of government assay offices, the provision of bounties, and technical education.

COMPRESSED AIR

By W. L. Saunders

(Vol. V, pp. 156-163.)

This paper contains much practical information on the above text, special reference being made to the subjects of cooling and after-cooling. The theoretically perfect compressor, it is pointed out, is one which draws in air at a temperature of zero or lower and discharges it compressed at normal or outside temperature. It is therefore advised that the compressor shall draw air from outside the engine room, and that it be provided with a thorough system of cooling, while the provision of an after-cooler between the compressor and the receiver is recommended. The question of lubrication is also discussed.

MINING AND CONCENTRATION OF CORUNDUM IN ONTARIO

By M. F. Fairlie

(Vol. V, pp. 164-170.)

The author describes the practice at the Canada Corundum Company's mine, known as the Robillard property, Raglan Township, Renfrew County, in the early stages of its operation. The practice has since been greatly modified and improved.

THE PRODUCTION OF COPPER IN THE BOUNDARY DISTRICT, B.C.

By Albert R. Ledoux

(Vol. V, pp. 171-177.)

Following a brief generalization on the geological relations, in the course of which the author asserts that the ores of Phoenix Camp are almost exclusively altered limestone, the ores of the district and the costs of mining and smelting them are the

subject of comment. The opinion is expressed that with a market price of $12\frac{1}{2}$ cents for copper many millions of tons of ore may be treated successfully. The ores on the north side of Phoenix ravine are estimated to average about 1.80 per cent. copper, $2.40 per ton in gold, and 25 cents per ton in silver; those on the south side, 1.70 per cent. copper, $1.60 in gold, and 33 cents in silver; while the value in the run of the mines in the Greenwood Camp as shown by the smelter returns, are placed at 1.60 per cent. copper, $1.80 in gold, and 50 cents in silver.

The cost of mining is said to have ranged from $1.66 to $2.10 per ton, while the costs of smelting and marketing are represented as being under $2.00 per ton.

ON THE USE OF WOOD GAS IN THE MANUFACTURE OF IRON AND STEEL

By James Douglas

(Vol. V, pp. 178-182.)

The author presents the results of experiment on the gasification of wood for gas engine purposes, avoiding the complication and waste consequent on gathering the volatile products of combustion in any form of condenser. This object was achieved by employing the Loomis-Pettibone Generator and Apparatus, but under a modified method of working, which is described. The opinion is expressed that this apparatus and process would be admirably applicable to the full conversion of the coarser waste from saw-mills, and even of saw-dust by introducing an inconsiderable modification in the disposition of the grate.

ELECTROLYTIC PRODUCTION OF METALS WITH SPECIAL REFERENCE TO COPPER AND NICKEL

BY WM. KOEHLER

(VOL. V, pp. 189-212 AND VOL. V, pp. 393-402.)

By way of introduction the author devotes some attention to the subject of electrolysis in general. The several processes for the electrolytic production of copper and nickel are then described in detail, including the Ulke process, the Wallace-Farmer process, the Marchese process, the Body process, the Siemens and Halske process, the Hoepfner process and the Frasch process. It is shown that the electrolytical production of copper as at this date reverts to two fundamental methods, namely: (1) The production from sulphate solutions; and (2) the production from chloride solution, and any variations of method claiming to introduce new and original ideas are more of a mechanical than a chemical nature.

On page 393, Vol. V, some of the author's statements are challenged by Mr. Titus Ulke, who describes the essential features of his process for the electrolytic refining of nickel. To this communication Mr. Koehler replies upholding his opinions as expressed.

A METHOD OF MINING LOW GRADE ORES IN THE BOUNDARY CREEK DISTRICT

BY FREDERIC KEFFER

(VOL. V, pp. 213-217.)

The method described is that employed at the Mother Lode mine, in Deadwood Camp, near Greenwood, B.C. The ore-body was divided into stopes 30 to 40 feet wide, the length of the stopes being the distance across the ore-body. Cross-cuts were made under the centre of each stope, and from these up-raises carried 30 feet apart, from 10 to 12 feet high, and were then connected by second and parallel crosscuts. From the latter

the stopes were opened to the proposed width, and then carried vertically upward, the short upraises being cribbed and furnished with gates for loading. Between the stopes, pillars of from 20 to 25 feet in thickness were left, these being frequently pierced to permit of intercommunication and ventilation. To supplement the output from underground, quarrying or "glory hole" methods are employed. The paper is illustrated with maps and plans.

THE OLD AND NEW IRON INDUSTRY COMPARED

By JOHN BIRKINBINE

(VOL. V, pp. 218-227.)

The author traces the history of the iron industry of the United States, noting in particular the improvements in mechanical appliances, which have rendered possible enormous outputs at small cost for labour, fuel and administration; and have materially reduced the requirements for skilled labour. He points out that the modern blast furnace, although three times as high, occupies no more ground space than its ancient prototype, and the equipment of 4,000 h.p. boilers, cross compound blowing engines supplying 1,000 cubic feet per second at pressures of 20 pounds or more, delivered through ten or more tuyeres into the blast furnaces at temperatures of 1,200 degrees F., seem strange developments from the weary water wheel forcing from its bellows or tubs a weak blast through a single open tuyere.

NOTES ON THE ECONOMIC MINERALS OF VANCOUVER ISLAND, B.C.

By W. F. BEST

(VOL. V, pp. 228-232.)

The minerals referred to are copper, coal, iron, gold, quicksilver, arsenic and antimony. The localities in which these minerals occur are specified and attention is directed to the favourable economic conditions obtaining, notably that of climate, for the prosecution of mining operations.

EASTERN ONTARIO: A REGION OF VARIED MINING INDUSTRIES

By Willet G. Miller

(Vol. V, pp. 233-255.)

In this paper attention is directed to the great variety of the mineral deposits in that part of the Province of Ontario situated to the east and south of the boundary line between the districts of Nipissing and Algoma. The minerals to which specific reference is made are nickel and copper, iron, gold, arsenic, pyrite, corundum, mica, talc, graphite, feldspar and actinolite; while a short account is also given of the cement industry in this section of the country. In each instance the author describes, briefly the character and mode of occurrence of the deposits, while referring also to the products obtained.

THE IRON-BEARING ROCKS OF THE NASTAPOKA ISLANDS

By G. R. Mickle

(Vol. V, pp. 256-264.)

The Nastapoka Islands extend from Richmond Gulf, Hudson Bay, in a continuous chain, for a distance of about one hundred miles. The iron-bearing rocks are jasper, a hard stratified hematite-magnetite siliceous ore, and manganiferous iron carbonate. The jasper beds are occasionally extensive, some being 40 feet thick, and even 100 feet thick. The other two mentioned types appear to occur as local enrichments or concentrations of metal in the rock in certain layers, the metal gradually diminishing in quantity in all directions horizontally, and merging into barren rock, there being no well-defined boundaries or walls.

Analyses of specimens taken from what appeared to be the best bed of ore of the carbonate type, gave: Manganese ,3.35 to 3.97; Iron, 33.35 to 34.07; Silica, 21.98 to 23.20 and Phosphorous, .018 to .091. The author remarks that even allowing the best prices quoted for the manganese and iron, these rocks are too low grade to work, being ruined by the high silica contents.

THE HARRIS SYSTEM OF PUMPING BY COMPRESSED AIR, AS APPLIED AT THE DELORO MINE

BY P. KIRKEGAARD

(VOL. V, pp. 265-273.)

At the Deloro Mine, Hastings County, Ont., an inflow of water was experienced while shaft-sinking, amounting to from 400,000 to 500,000 gallons per twenty-four hours. The author conceived the idea of impounding most of this water, making a permanent pumping station on the third level, and thus leaving the lower workings dry. It was decided that the "Harris" system of lifting water by direct air pressure, not only was economical but the construction necessary was such as to require no machinery in the mine, other than two tanks and some pipes connecting the tanks with the machinery on the surface; and with this system there could be no drowning, no matter what happened to the surface equipment. In brief, the Harris system of air-lift comprises the two tanks already mentioned which are connected by the air pipes to an automatic switch placed in the engine house on the surface, the switch in turn being connected with an air-compressor. The principle of the system is fully described both in the text and diagrammatically. The plant was in continuous operation for over a year, during which period the minimum duty was 300,000 gallons of water, and the maximum 650,000 gallons per twenty-four hours.

NOTES ON THE MILLING OF GOLD IN THE REPUBLIC DISTRICT, WASH.

BY FRITZ CIRKEL

(VOL. V, pp. 274-287.)

These notes deal with the mills erected and processes employed at the Republic and Mountain Lion mines respectively. At the Republic, a small mill, of 30 tons daily capacity, for the treatment of the ores by the Pelatin-Clerici process, was first installed. With this the recovery was from 55 to 80 per cent.

only, sometimes falling to 50 per cent., while the cost of treatment was about $8 per ton. A large mill, of 200 tons daily capacity, was then built, which except for the fact that the supply of ore was inadequate, is said to have yielded satisfactory results. The process employed was that of dry grinding to 60 mesh, roasting "dead," and cyaniding. The operations are minutely detailed by the author. The mill erected at the Mountain Lion, was designed to treat the ore by a patent process, including amalgamation and cyanidation. The recovery during a six months' run represented 54.9 per cent. gold and 26.9 per cent. silver.

NOTES ON OIL FURNACES FOR ASSAYING AND MELTING

By CHARLES BRENT

(VOL. V, pp. 288-295.)

The advantages in the use of oil fuel—petroleum, either as gasoline, refined oil or fuel oil—over any other class of fuel, wherever steam or compressed air can be obtained, for assaying or melting furnaces are here enumerated. The author also describes furnaces specially designed to afford the best results with oil fuels.

CERTAIN CONDITIONS IN VEINS AND FAULTS IN BUTTE, MONTANA

By WM. BRADEN

(VOL. V, pp. 296-308.)

It is premised that faults are by no means an unwelcome feature to the engineer, as they often form an indication of the vein's relations to its surroundings, and may directly or indirectly indicate the genesis and life of the ore deposits. The general geology of the Butte district is then outlined and some characteristic features, observed by the author, noted, especially as regards the occurrence of faults.

HOISTING AND HAULAGE IN MINING OPERATIONS A DESCRIPTION OF THE PLANT ON THE LE ROI MINE, ROSSLAND, B. C.

BY BERNARD MACDONALD

(VOL. V, pp. 307-342.)

In order to show the economies effected as a result of a new plant installed by the author, a brief history of the operation of the Le Roi Mine is presented, including a statement of costs under former and present managements. The hoisting and haulage machinery, which is stated to possess many novel features, both of design and application, is then described. The author concludes that for the economical operation of mines where a large output can be maintained, the following equipment and facilities should be provided:

1. An efficient system of hoisting and haulage.
2. Facilities to ensure, as nearly as may be, the continuous operation of every unit of the plant comprising the system.
3. Intermediate storages for ore, in the mine and between the different sections of the plant, to provide against the stopping of the plant if an accident to any one of the units occur.
4. Separate sets of hoisting compartments for the ore, and for the general traffic of the mine, the skips or cages of each set to be operated in counterbalance.
5. All loading from the main storage bins to be done through chutes opened and closed by compressed air.
6. Where hand sorting of ore is advisable, travelling tables passing before the sorter at a speed not exceeding 45 feet per minute, should be employed.
7. The waste and second grade ore should be picked out and dropped into bins beneath the sorting floor, the sorted ore being conveyed and delivered to the sampling machinery automatically.
8. The boiler plant should be installed not nearer than 200 feet to any of the other units of the system.
9. The convenient grouping of the various units of the surface plant adjacent to the entrance of the mine.
10. An efficient system of fire protection, operating preferably by gravity, or, a combination of gravity and pumping.

ASBESTOS AND ITS PRODUCTION IN CANADA

By W. Mollmann

(Vol. V, pp. 343-357.)

The properties, occurrence and uses of asbestos are discussed, and special reference made to the Quebec deposits and methods of operation.

ON THE POSSIBLE OCCURRENCE OF A COAL AREA BENEATH THE NEO-CARBONIFEROUS OR PERUVIAN STRATA OF PICTOU COUNTY, NOVA SCOTIA

By H. M. Ami

(Vol. V, pp. 358-364.)

The "North Fault," to which is ascribed a vertical displacement or throw of several thousand feet, is one of the most important faults of the Pictou district. Alongside this fault, and in the vicinity of its line of outcrop, near Blackwood Brook, New Glasgow, the black bituminous and coal-bearing shales of the productive coal measures are seen to abut against the tilted sandstones and associated strata of the older and subjacent Westville or "millstone grit" formation.

The author, on the assumption that the New Glasgow conglomerate overlies the "millstone grit" or Westville sandstones at Blackwood Brook, (which latter dip to the north) conjectures that boring would discover a coal field north of the great north fault, and in the vicinity of and underneath Trenton or the country to the north, between the Straits and the fault. He adds that the prevalence of the coal basin depends upon the continuity of the unconformable contact between the two series of sediments, such as are exposed in Blackwood Brook.

THE ORE DEPOSITS OF THE BOUNDARY (CREEK) DISTRICT, B. C.

BY R. W. BROCK

(VOL. V, pp. 365-378.)

For convenience the ore-bodies here described are classified as follows: (1) The large low-grade copper-bearing sulphide deposits; (2) the oxidized copper veins, and (3) the small gold and silver-bearing quartz veins. In structure the deposits under the first heading, belong to the composite-vein type, formed by mineralizing solutions traversing the country rock, principally along fissures or zones of fissures and replacing the original material of the country rock with metallic minerals. The deposits are again sub-divided into a pyritic type, in which pyrrhotite, chalcopyrite, with some pyrite, are the principal minerals; and a magnetitic type, in which magnetite, chalcopyrite, with some pyrite predominate. In age the deposits are probably early Tertiary. The deposits of the second class are described as being, probably, an oxidized and secondarily enriched form of a sulphide deposit and produced by the action of surface waters. The iron of the sulphides has been removed or redeposited as hematite or limonite; the copper has been more or less concentrated in the form of various oxidized minerals. The quartz veins, constituting the third type of deposit, are in age and mode of occurrence little different from those previously described, probably representing the closing stage of mineralization. They are sometimes parallel to the large sulphide bodies, but do not, as a rule, show the same regularity in their strike. In form they are more regular and are usually enclosed between well-defined walls. The chief metallic minerals are chalcopyrite, pyrite, arsenopyrite, galena and zinc blende. As a result of his observations the author presents some practical conclusions, summarized as follows:

"Ores may be found in any of the older rocks where the other conditions for mineralization were favourable.

"Districts which show evidence of late disturbances through vulcanism, manifested by intrusions of recent eruptives and heavy dyking, are promising fields for prospecting.

"Limestone contacts in such areas should, in particular, be carefully prospected.

"No loss of values is to be expected in depth." (Exclusive of the deposits of the second class, which are restricted to one locality.)

A careful and detailed study of the surface of the ground in the neighborhood of the mines is advised, and magnetic surveys to discover ore bodies under the covering of drift, are recommended.

SAFETY LAMPS AND COLLIERY EXPLOSIONS

By James Ashworth

(Vol. V, pp. 379-392 and Vol. VI, pp. 200-213.)

Experiments, it is stated, have proved that gauze lamps of the Davy type, cannot, on account of their large cubic contents, withstand an explosive current of the lowest velocity; for the ignition of a large volume of fire-damp exerts such a high velocity that the flame is forced through the mesh of the wire almost instantaneously, and without waiting to overheat the gauze. The author describes and discusses the relative merits or demerits of safety lamps of various make and type, endorsing the Gray, or Ashworth's patent Hepplewhite-Gray lamp for gas-testing. He concludes with a recommendation to Canadian colliery managers to carefully consider the subject of gas detection, "and thus provide against the horrors of colliery explosions as well as against the great loss of capital which these disasters inevitably cause."

In Vol. VI, (pp. 200-213) the subject is discussed by Messrs. William Blakemore, W. D. L. Hardie and James Ashworth. Mr. Blakemore remarks that in the Fernie explosion the evidence indicated that the Clanny lamp was responsible. He adds, that in his opinion, coal dust is relatively more dangerous in a coal mine than fire damp.

Mr. Hardie endorses Mr. Ashworth's favourable verdict on the Ashworth-Hepplewhite-Gray lamp, but states that by far the larger number of explosions on the American continent take place in dry and dusty bituminous coal mines.

THE LE ROI MINE

By Oliver Hall, Student.

(Vol. V, pp. 403-423.)

The author presents a comprehensive and detailed description of the Le Roi Mine, at Rossland, B.C., including an account of the equipment, method of working, labour conditions, etc.

MINE TIMBERING IN THE OLD IRONSIDES AND KNOB HILL MINES

By H. P. De Pencier, Student.

(Vol. V, pp. 424-446.)

The paper, which is very profusely illustrated, describes the methods of timbering in the Old Ironsides and Knob Hill mines, at Phoenix, in the Boundary Creek District, B. C. The ore bodies here, as is well known, are of immense size, but the ore in the wide mineralized zone does not form a very strong rock, though where (as in the Knob Hill) there is not much water and it has not been shattered, it forms a fairly safe roof for drifts and crosscuts. The timber used, pine, spruce, tamarac and Douglas fir, is obtained in the locality. The three last mentioned varieties are regarded as nearly of equal value, the fir being the strongest and all three being stronger than the pine, which, however, has the advantage of being softer and, crushing more easily, thus takes up the load more evenly. In the shafts, both cribbing and timbering with square shaft sets is found. The method of framing for cribbing envolves a halved joint combined with a bevelled hitch on the inside to resist lateral pressure. In the stopes the square sets are of round timber, 8 feet in height placed 5 feet apart, with cap pieces to hold them in their relative positions laterally. The framing is specially designed to carry vertical pressures, and the system of timbering is very elastic and can be applied to ore deposits of almost any shape and size.

MINING IN THE ROSSLAND DISTRICT

By C. M. CAMPBELL, Student.

(VOL. V, pp. 447-483.)

A short description of the geology of the district is followed by an account of the methods of mining employed at the larger mines. Among the subjects discussed are diamond drilling, shaft sinking, raising, timbering, blasting, tramming, hoisting and ventilation. The surface equipment of Le Roi, War Eagle, Centre Star and other properties is described and statements of production and of wages paid to miners and other workmen are appended.

POWER DRILLS

By C. C. HANSEN, Student.

(VOL. V, pp. 484-492.)

A description of the better known types of power drills is presented, and the author comments on their individual characteristics.

THE ORE DEPOSITS OF COPPER MOUNTAIN, SIMILKAMEEN DISTRICT, B. C.

By O. N. SCOTT, Student.

(VOL. V, pp. 493-502.)

Copper Mountain is about 10 miles south of Princeton, on the east side of the Similkameen River, in the Similkameen sub-division of the Yale District, B.C. The district contains many large deposits of low grade copper ores, notably those found at Copper Mountain, which form the subject of this paper. The author describes the ore body as being roughly defined on the north by a quartz porphyry dyke, which constitutes the hanging wall. Contiguous to the dyke is the copper ore, not

occurring in a well defined vein, but in the form of bornite and chalcopyrite, impregnated and disseminated through the basic andesite, forming a large deposit that can be traced in an easterly and westerly direction for over 3,000 feet, and varying in width from 50 to 250 feet. An average sample of the ore is stated to have yielded by analysis, copper, 4.66 per cent.; gold, 20 cents to $1.50; and traces of silver. The author concludes that "under competent management, and a careful development of the deposits, together with a local supply of fuel, these ore bodies promise to become valuable copper producers in the near future."

NOTES ON THE GEOLOGY AND A FEW ORE DEPOSITS OF SOUTH EASTERN BRITISH COLUMBIA

By C. V. CORLESS, Student.

(VOL. V, pp. 503-527.)

The author endeavours to show that the ore-bodies to which he refers, namely the argentiferous galena deposits of the Slocan, Ainsworth and Fort Steele Mining Divisions, the auriferous copper-bearing pyrrhotite deposits of Rossland and Boundary districts, and the deposits at Nelson, producing ores which appear to be mineralogically transitional, form part of a related group; suggesting that, probably, veins formed in a similar way over a still wider area may be similarly related, owing to the derivation of their metals, mainly, if not altogether, from the deeper part of the zone of rock fracture, and from igneous masses intruding into this zone.

THE SULPHIDE ORE BODIES OF THE SUDBURY REGION

By L. P. SILVER, Student.

(VOL. V, pp. 528-551.)

The deposits are grouped under three general heads, namely, contact deposits, impregnations of the pyrrhotite and chalcopyrite through the greenstones, and as segregation veins. Analyses of typical samples of the greenstone are presented and the author notes the theories that have been advanced to explain the genesis of the deposits. An account is also given of mining and metallurgical operations at Copper Cliff.

MINE DEVELOPMENT METHODS

By B. J. FORREST

(VOL. VI, pp. 1-5.)

A number of suggestions are offered respecting the development of iron and coal mines.

PROGRESS IN MAGNETIC CONCENTRATION OF IRON ORE

By J. WALTER WELLS

(VOL. VI, pp. 6-20.)

After remarking on the importance of the subject under consideration, in view of the limited available supplies of high grade iron ore, the author proceeds to review the methods of concentration. So far as this country is concerned, he remarks that local conditions favour magnetic concentration, since there is abundance of cheap water power available in the iron districts, while no expensive plant is necessary. Magnetic concentration depends on difference in magnetic permeability, magnetite being the most susceptible to the influence of the magnet, and

in succeeding order, franklinite, ilmenite, pyrrhotite, hematite, siderite and limonite. The different types of magnetic concentrators, that have been more or less commercially successful, are divided into four classes and each type is described by the author. These include:

(1) Those with the ore conveying belts passing a magnetic field. Examples are the Conkling, Wetherill, Chase, Hoffman, Kessler, etc.

(2) Those with the ore on a rotating cylindrical drum within which are magnets. Examples are the Ball-Norton, Heberli, Wenstrom, Buchanan, Sautter, Siemens, Payne, etc.

(3) Those in which the ore falls vertically past magnets. Examples are the Edison, Heberli, Grondal-Delwik, Rowand, etc.

(4) Those in which static electricity is utilized, materials conducting the charge being repelled from those which do not become magnetized. The only example is the Blake-Morscher type, used for separating zinc from lead ores.

A description is also given of concentration practice at the Hibernia mines, New Jersey.

NOTES ON THE MINERAL INDUSTRY IN THE NINETEENTH CENTURY

By Willet G. Miller

(Vol. VI, pp. 21-46.)

The author summarizes a review of the progress of the mineral industry in the nineteenth century, prepared by Prof. E. Treptow, of Freiberg, re-arranging some of the material and adding thereto. The subjects covered include the progress in mining technology; the notable increases in precious metal, in iron and in coal production; and the discovery and utilization of metals not before known. Thus the new useful metals of the 19th century are shown to be, zinc, platinum, nickel and aluminium, together with manganese, chromium, tungsten, bismuth and magnesium. The concluding pages are occupied with a review of the minerals employed in the chemical industry.

MOLYBDENITE—ITS OCCURRENCE, CONCENTRATION AND USE

BY J. WALTER WELLS

(VOL. VI, pp. 47-65.)

The results are presented of experiments conducted by the author to determine the different methods of concentrating molybdenite ores.

The following scheme of treatment is suggested as being probably the most suitable for an ore carrying about 50% pyrrhotite, 10% pyrite with calcite, mica, quartz, pyroxene, etc., and 6.5% molybdenite:

Hand cobbed ore.

–|–

Jaw crusher (0.50″)—Hand picking of large flakes of molybdenite detached.

–|–

Rolls (0.20″)

–|–

Screen (0.30″)— –|– oversize—(mica and molybdenite)

–|–

Screen (0.20″)— –|– oversize—(mica and molybdenite also a little rock.)

Screen (0.10″)— –|– oversize (mica, molybdenite, rock matter.)

–|–

Screen (0.05″)— –|– oversize (mica, molybdenite, rock.)

–|–

Wilfley table to save the pyrite and pyrrhotite as an ore of sulphur.

Magnetic separation is advised for cleaning the oversize products from the screens none of which was of commercial grade.

A list is included in the paper of Canadian localities in which molybdenite occurs; and, in addition, a volumetric method for estimating molybdenum in its ores, together with a statement on the industrial uses of molybdenite and its products, are presented.

MINERAL PRODUCTION, CANADA AND UNITED STATES

By GEORGE JOHNSON

(VOL. VI, pp. 66-72.)

On the basis of the mineral returns of the United States and Canada, respectively, for the year 1901, the development of the two countries in the production of mineral wealth is compared. It is shown that in this year the mineral production of the United States represented a value per capita of $14.12, while that of Canada was at the rate of $12.42 per capita; but the United States increased its per capita output in 1901 as compared with 1891 by $4.20 and Canada by $8.50. Other interesting comparisons are made.

VOLCANIC ORIGIN OF NATURAL GAS AND PETROLEUM

By EUGENE COSTE

(VOL. VI. pp. 73-128.)

In proof of the volcanic origin of natural gas and petroleum the author gives numerous instances of carbon and hydrocarbons in ancient plutonic rocks as well as in the present volcanoes, the other associated gaseous emanations of which, as well as their solfataric phase, he reviews. He indicates the true analogy of the volcanic emanations and phenomena to the products and conditions found in all the oil and gas fields; and endeavours to prove the complete inadequacy of all organic theories.

MINE TIMBERING BY THE SQUARE SET SYSTEM AT ROSSLAND, B. C.

By Bernard MacDonald

(Vol. VI, pp. 129-145.)

The square set system of timbering was invented by Philip Deidesheimer, while Superintendent of the Ophir mine, on the Comstock Lode, in 1860. In mines where the ore extracted exceeds a width of 12 or 15 feet, the system is the cheapest and most effective method of timbering. In the Rossland mines, the ore deposits have widths ranging up to 100 feet or more. The ore and the enclosing rock is extremely hard, and the veins dip at angles of about 70 degrees. The conditions facilitate and simplify timbering, without, however, doing away with its necessity. The special methods employed in the Rossland mines are described, the total cost per square set, hand framed, being given as $4.00, the cost of material being estimated at $1.50. The cost per ton, for hand framed timber would be about $0.17; by machinery, $.0.15.6. In addition the costs of chutes, floors, ladders and railings, add to the cost $1.20 per square set. Under conditions, which are stated, reinforcement is necessary and the methods employed are described. The round logs or timbers, 16.5 feet in length, used for the square sets at Rossland, cost, delivered at the framing sheds, $1.20 each. Where sawn lumber is relatively cheap, the use of 3-inch plank is recommended in preference to lagging poles for floors, on account of the better surface it affords for shovelling.

DEVELOPMENT OF COARSE CONCENTRATION IN THE SLOCAN DISTRICT, B. C.

By Samuel S. Fowler

(Vol. VI, pp. 146-160.)

By way of introduction the history of mining, the geological and physical features, and the character of the mineral products of the Slocan district are reviewed. The author then enumerates the mills in operation and outlines the process, showing that the gen-

eral course of products through the mill does not differ in any material respect from that of other regions where coarse concentration is practised. An examination of details and results indicates, however, that better work might be done and the author, therefore, intimates in what direction improvement is possible. A statement is appended of costs of concentration, representing the returns of one of the more important mills, the cost in this case being $.3406 per ton, exclusive of depreciation, insurance or handling and disposal of product, which later item would add $.0557 to the cost per ton of ore. The cost of sacking represents 56 cents per ton.

MINE SIGNALLING BY COMPRESSED AIR

By BERNARD MACDONALD AND WM. THOMPSON

(VOL. VI, pp. 161-168.)

The defects of the Pull Bell System are pointed out. Of these the authors had practical evidence. Realizing that signalling between the conductor and engine-driver on an express train is effectively done by means of compressed air, it was determined to apply the same method to mine use. The same apparatus practically was employed; namely a whistle placed in the engine room, a signal pipe, carried down to the deepest workings; a signal valve; a reducing valve and a discharge valve. The entire cost of installation was $127.50 only, and the system is stated to have given great satisfaction.

NICKEL DEPOSITS IN NEW CALEDONIA

By R. G. LECKIE

(VOL. VI, pp. 169-179.)

No systematic geological survey of the island of New Caledonia has been made. The author states that the gneisses and mica schists of the older formations are strongly developed in the northwest and upon these rest the sericite and talc schists

and crystalline limestone of the Silurian. The peridotite has overflowed these and in the derivative serpentine the ores of nickel, cobalt and chrome are found. The rocks of New Caledonia have been subjected to severe seismic disturbance, in which the serpentines have been fissured and broken. This shattering has facilitated the disintegration and decomposition of the rock, into the cracks and crevices of which the original metallic constituents have segregated. From these the nickel ore of commerce is dug. Occasionally veins are encountered having a width of from six inches to two feet, but they are not found to be persistent in either length or depth. The ores are spread over a large area, but confined to a comparatively shallow zone of from fifteen to twenty-five feet. In mining the ores no blasting is required. It is gathered into piles and graded to ensure an average of not less than 7 per cent. nickel. The waste dumps usually carry 3 to 4 per cent. nickel. The production has ranged from 110,000 to 140,000 tons annually. The ore is particularly well adapted for the production of ferro-nickel.

COMPARISON OF COSTS OF COMPRESSED AIR WITH STEAM AND ELECTRICITY AT ROSSLAND, B.C.

BY WM. THOMPSON

(VOL. VI, pp. 180-187.)

In provision for cheap power Rossland is especially favourably situated. Coal from near-by collieries is supplied at a low cost; and electric power, from Bonnington Falls only forty miles distant, for any service demanded of it is available. Nearly every mining district in southern British Columbia is equally fortunate in these regards, and the author, therefore, considers that the results obtained in the air compressing plants at Rossland will prove of special interest. These data are tabulated, the results indicating that the cost of operating the steam plant represented $61.56 per horse power per annum as compared with $46.44 in the case of electricity; while the cost for each 100,000 cubic feet of free air compressed by steam plant was $1.56, and by electric plant $1.46, the result in this case being a saving of 6.4 per cent. in favour of electricity over steam.

MINERAL RESOURCES OF VANCOUVER ISLAND

BY W. M. BREWER

(VOL. VI, pp. 188-199.)

The mineral resources of Vancouver Island comprise coal, gold ores, copper-gold ores, a little galena and magnetite. The author presents a short history of coal and metalliferous mining on the Island and sketches the geology of the areas in which economic minerals are found.

THE STEWART RIVER GOLD DREDGE

BY A. W. ROBINSON

(VOL. VI, pp. 214-223.)

The author describes a gold dredge designed by himself for operation on the Stewart River, Yukon. He believes that the class of machinery previously constructed for work of this nature has been entirely too heavy and cumbersome to send to such remote regions where the cost of freight is so high and the loss from breakdowns is great. To this end the dredge in question was designed to combine the greatest possible strength with lightness, the important parts subject to strain being constructed of the best quality steel.

THE FUTURE OF THE COAL AND COKE SUPPLY OF BRITISH COLUMBIA

BY WILLIAM BLAKEMORE

(VOL. VI, pp. 224-232.)

Premising that the future prosperity of the province depends on an abundant supply of the best quality of fuel at a low price, the author states that this controlling factor is determined by two conditions—the general low grade values of the ores, and the fact that the geological formation forbids the existence of coal in proximity to the metalliferous deposits and so involves more or less costly transportation. He discusses the available sources of fuel, both for steam and metallurgical purposes, and the facilities at the time afforded for marketing the coal.

AIR COMPRESSION BY WATER POWER THE INSTALLATION AT THE BELMONT GOLD MINE

By D. G. Kerr

(Vol. VI, pp. 233-244.)

The power was derived from falls, giving a head of 75 feet in a distance of 1,600 feet, situated about three miles from the mine. The question to be decided was whether to use electricity or compressed air. The generation and transmission of electricity would have cost less at the power house and to the mine, but it would have been necessary to have provided a motor driven air compressor at the mine to supply drills with air, and motors at hoist and engine. This would have brought the first cost of the electric installation to a higher figure than that for one large air compressor plant. It was consequently determined to install a large air compressor plant at the water power and carry the compressed air in pipes to the mine. The author gives a detailed description of the plant. It is anticipated that the loss in pressure due to friction in transmission will be $3\frac{1}{2}$ pounds.

GENESIS OF THE ANIMIKIE IRON RANGE

By F. Hille

(Vol. VI, pp. 245-287.)

The author believes that iron "exists on the Ontario side of the line under the same conditions as in the Mesaba and other ranges." He disagrees fundamentally with Profs. C. R. Van Hise, C. K. Leith and other eminent geologists, especially as regards the effect of glacial erosion on the Canadian deposits. He maintains that the iron-bearing rocks are still intact in Ontario, and "especially those portions which, on account of their great thickness, hold out promise of containing the largest deposits of ore." Respecting the genesis of the Animikie iron-bearing rocks, the author develops somewhat original ideas, and considers that the ferruginous cherts found in this region were converted into iron ore by an "absorption process."

THE MODERN BLAST FURNACE LABORATORY AND ITS WORK

BY W. DIXON CRAIG

(VOL. VI, pp. 288-300.)

The work of the blast furnace laboratory is considered under three heads; analysis of raw material; analysis of product; and analysis conducted for furnace control. Detailed notes are given on some of the methods of chemical analysis employed at the Canada Iron Furnace Company's laboratory, at Midland, Ont. A description and plan of the laboratory itself are also presented.

NOTES ON MACHINERY CONSTITUTING A MINING PLANT

BY ALFRED C. GARDE

(VOL. VI, pp. 301-305.)

Some practical suggestions are here offered on the subject of the class and character of machinery that should be provided in the operation of a property, proved to a depth of over one hundred feet. In respect of hoists, the use of a cast steel gear, together with a rawhide pinion is recommended. The use of a skip or a skip-car is advocated in preference to a cage; but to make the skip system a success it is necessary to place bins or ore-pockets at each station in the mine to receive the ore or waste from each shift. There should also be a storage bin at the top landing. For hoisting rope a flexible plough steel, six strands 19 wire rope, is stated to be the best.

NOTES ON ROASTING WITH McDOUGALL FURNACE

By S. S. Sorensen

(Vol. VI, pp. 306-312.)

The advantages of calcining furnaces of this type are shown to be: (1) They are simple in design and simple to operate. Expert furnacemen need not be employed, since ordinarily intelligent labour, under proper supervision, is all that is needful. There is a minimum of gearing, no elevators with their complications, no forced draught nor fans with their dust. There are no strains from sudden or unequal expansion and contraction from alternate heating and cooling of parts; and a minimum of parts and patterns for spares need be carried. (2) They are economical in fuel, labour and in power. (3) They produce a good grade of calcines for the purpose required, (matte smelting), namely, low sulphur, high ferrous with low ferric iron. And they accomplish this with but little waste in flue-dust or otherwise, and in quick time.

SOME POSSIBILITIES OF MINING IN CANADA

By Frederick Hobart

(Vol. VI, pp. 313-316.)

The author considers that in the immediate development of the mineral resources of Canada, the greatest possibilities for the future are presented in iron and copper mining. In respect of copper, he remarks on the extent of the deposits of ore and the proximity of fuel and other materials requisite in its production as eminently favourable factors, and points out that the mines and smelters that have been able to maintain their production on the basis of 11 cents, must necessarily prosper when the market price of copper reaches 13 or 14 cents. The establishment of an electrolytic copper refinery at some convenient point is urged. The iron resources of the Dominion are referred to, and the author remarks that from the trade vantagepoint, Canada is exceptionally well situated for the development of an important iron and steel industry.

ECONOMIC GEOGRAPHY

By James White

(Vol. VI, pp. 317-326.)

Attention is directed to the value of good maps. As an example, if our plenipotentiaries when negotiating the Treaty of Versailles had had even fair maps before them Canada would now include a large portion of eastern Maine; and the boundary line, instead of following Pigeon and Rainy rivers to the Lake of the Woods, would have been carried up the St. Louis to the Mississippi and thence westward on about the parallel of 48 degrees. To the miner and prospector good topographic maps are invaluable. While praising the maps prepared by the Department of the Interior and Geological Survey it is noted that undue delay in publication has occurred and is occurring, and that geographical information, which, if published, would be invaluable to the mining and other interests of the country, is locked up in note books. The author quotes from a report of the Civil Service Commission of 1892 recommending that a special cartographic branch be created whose duty shall be to issue reliable maps of the various parts of the Dominion. A description is given of a museum of economic geography, suggestive of what might be done in this regard in Canada; and the character and scope of a proposed economic atlas to be issued under the auspices of the author, are outlined.

NOTES ON THE GOLD ORES OF WESTERN ONTARIO

By Charles Brent

(Vol. VI, pp. 327-335.)

The geological relations are explained and the general character of the deposits described. The ores are stated to be generally "free-milling" from 70 to 90 per cent. of the total gold contents being recoverable by simple battery amalgamation. A satisfactory percentage of the remaining values may be obtained by subsequent concentration and chlorination, or cyaniding, or by direct cyaniding without previous concentration.

The "free-milling" character of the ore is maintained at depth and, the author remarks, since from a geological standpoint there is no reason why the deposits themselves may not go to as great depths as are practicable to mine, it would seem, that in spite of many disastrous failures up to date that . . . . money and common sense will ultimately make a profitable and permanent mining industry in Western Ontario, for there is no district in the world where so many classes of gold-bearing deposits are known, and nowhere else is there such a widespread diffusion of the precious metal.

MINING POSSIBILITIES OF THE CANADIAN ROCKIES

By BERNARD MACDONALD

(VOL. VI, pp. 337-354.)

The belief is expressed that in the region of the Canadian Rockies, the mineral resources of which are as yet undeveloped, lies the source of an enormous supply of what the author calls "money metals." The prosperity of any country, it is added, is in direct ratio to the volume of metallic money, or money metals, constituting the base of its currency circulation. And, as prosperity ministers most to the wants and otherwise contributes to the happiness and greatness of a nation, it is the plain duty of governments, acting through wise legislation, to provide measures, under the operation of which the people may accumulate a large volume of metallic money.

After showing that the Rocky Mountain region of Mexico has produced precious metals to the value of $5,500,000,000, or an average production of $3,142,857 per mile; and the Rocky Mountain region of the United States, $4,500,000,000, or $3,461,538 per mile, it is urged that the Canadian Government undertake a systematic exploration of the Rocky Mountain region within Canadian territory. This region is approximately

1600 miles in length, by at least 500 miles in breadth and covers an area of over 800,000 square miles, or eight times the area of Great Britain and Ireland. It is shown that it has already produced $166,000,000 in precious metals and, the author adds, "no one can place a limit on the number of 'Cripple Creeks', or 'Klondykes' or 'Rands' that lie hidden away in the recesses of the 1600 miles of Rocky Mountains now practically unexplored in Canadian territory." The lines on which such government exploration should be based are suggested.

THE INFLUENCE OF GOVERNMENT UPON MINING

By EDMUND B. KIRBY

(VOL. VI, pp. 355-371.)

This paper was primarily written to show that the mining industry in British Columbia was unfairly and over-heavily taxed. The tax regarded as especially objectionable was that of 2 per cent. on the gross output. This was subsequently removed. Many of the author's statements, which appeared to be exaggerated, were challenged by some members in the discussion that followed the presentation of the paper.

NOTE ON ASBESTOS MINING IN ASIATIC RUSSIA

By H. C. REIHLE

(VOL. VI, p. 372.)

Reference is made to the Corewo and Baron Girar de Soukanton asbestos mines. The mines are remarkable in that with a production of from 1500 to 1700 tons of asbestos in a season, mining is performed without the aid of machinery or explosives. Ordinary labour is paid at the rate of from about 33 to 38 cents a day, with free sleeping quarters.

MINING IN THE NORTH-WEST, 1902

By FRANK B. SMITH

(VOL. VI, pp. 373-375.)

The author briefly reviews the coal mining industry in what is now the Province of Alberta and Saskatchewan for the year, 1902.

ROCK DRILLING AND BLASTING

By NORMAN W. PARLEE, Student.

(VOL. VI, pp. 376-389.)

A general exposition of the subjects.

ON THE MANUFACTURE OF SULPHURIC ACID AT SYDNEY, C. B.

By C. A. MEISSNER

(VOL. VI, pp. 390-407.)

The manufacture of sulphuric acid for the purpose of making sulphate of ammonia, or for uses in the sulphite wood pulp industry, is one of the branches of the coke department where coke is made in patent ovens and the by-products are saved. Ammonium sulphate is made from the ammonia in the gas from the ovens, which is washed out and the resulting gas liquor is mixed with milk of lime which liberates the fixed ammonia, and passed through suitable stills where it comes into contact with steam. By this means the free and combined, or fixed, ammonia is given off in gaseous form, and then passed into sulphuric acid contained in lead lined tanks. The manufacture of sulphuric acid at Sydney is carried out by what is known as the chamber process, which is outlined. Analyses are given of the Newfoundland ores from which the acid is made.

A FEW SUGGESTIONS ON MINERAL STATISTICS

BY EUGENE COSTE

(VOL. VI, pp. 408-410.)

The author points out that clearness is the essential characteristic of well-compiled statistics. He suggests a system based as follows:

(1) Separate statistics of the first marketable products of our mines and quarries—spot values.

(2) Separate statistics of our smelting and metallurgical works—spot values.

(3) Separate statistics of the products of other mills or works using ores or minerals, such as petroleum refineries, cement mills, brick yards, lime kilns, etc.—spot values.

NOTES ON THE GEOLOGY OF THE NORTHERN PORTION OF THE BOISDALE HILLS ANTICLINE

BY SHERMAN H. BORIGHT, Student.

(VOL. VI, pp. 411-434 .)

The Boisdale hills are situated in Cape Breton Island. The area of which this paper treats, embraces about four and a half miles of the northern portion of the hills, taking in the country on the west as far as the shore of Little Bras d'Or Lake, and, including also Long Island. On the east it extends to Jessop's Point and from there, parallel with the hills, as far south as the southern extremity of Long Island. Two sections are presented showing the relation of the various carboniferous and metamorphic basins to the older underlying felsites, syenites, granites, etc.

NOTES ON MINING AND SMELTING IN THE BOUNDARY DISTRICT, B. C.

BY FREDERIC KEFFER

(VOL. VII, pp. 42-46.)

The author supplements information previously conveyed to the Institute on the quarrying and economical handling of low grade copper ores in the Boundary District. At the Mother Lode mine, while the pits remained shallow it was an easy matter to remove barren or very poor rock; but as the funnel system developed it became quite inadvisable to remove any but large bodies of waste, for the cost of removal had become greater than the cost of smelting. The presence of waste with the ore shipped was not noticeable, since there was an increase in metallic values in the ores at the greater depth. A note is made of improved crushing facilities provided; and it is observed that the ores of the larger mines have as a rule grown less basic as the workings have extended and deepened. This is illustrated by average slag analyses.

THE ORE DEPOSITS OF ROSSLAND, BRITISH COLUMBIA

BY EDMUND B. KIRBY

(VOL. VII, pp. 47-58.)

Active production commenced in the Rossland district in 1894. The total yield to Jan. 1st, 1904 is stated to have been 1,620,540 tons, containing about $26,000,000 gross value, or $16.00 per ton in gold, silver and copper. The geological position of the ore-deposits is shown on a map, the elongated oval area of gabbro appearing as surrounded by a border of varying width of augite and uralite porphyrites and fine grained green diabases. The active mining has been carried on outside the gabbro area and in the porphyrites at its western edge. The country rock is evidently derived from the same magma, and is mainly composed of plagioclase feldspars and pyroxene. The country rock is cut by innumerable dykes. The veins are

sheer zone fissures consisting of a series of parallel platings of the rock produced by shearing under high compression. The ore consists of country rock more or less replaced or impregnated by pyrrhotite, accompanied in places by small proportions of chalcopyrite, pyrite, arsenopyrite and quartz. The distribution of ore and ore shoots in the principal mines is detailed. The conclusions reached are: (1) That the pyrrhotite was deposited from aqueous mineral solutions ascending through the more fractured and permeable portions of the shear zone fissures. (2) The gold-bearing chalcopyrite, pyrite and arsenopyrite with quartz were deposited later from the same flow rising within the same channels which still remained unfilled, or which were re-opened by further fracturing of the friable pyrrhotite ore. (3) The main faults and some of the dykes existed before the formation of the pyrrhotite began, or at least before its principal deposition. (4) Their intersections with the vein planes made barriers which more or less directed the flow, accumulated the solutions, and determined the position of the main ore bodies. (5) After the ore formation more dykes appeared. Faulting was repeated intermittently, continuing probably up to recent times, and the early fractures were kept alive.

In these deposits it is impossible to even consider "direct igneous origin," or "magmatic segregation," and no evidence has been found to suggest any difference between their origin and that of ore deposits of galena, pyrites or other minerals whose genesis is now established.

METHODS OF OBTAINING WATER SUPPLY, FOR SUGAR PLANTATIONS IN THE HAWAIIAN ISLANDS

By J. N. S. Williams

(Vol. VII, pp. 70-81.)

These methods include conveying water in ditches and syphon pipes; by tunnelling; by artesian borings; and by pumping. The paper contains valuable formulae and other data in relation to these operations.

NOTES ON THE CONSTRUCTION OF MINE BULKHEADS

BY WILLIAM THOMPSON

(VOL. VII, pp. 82-86.)

It was required to design and construct a number of mine-bulkheads free from danger of collapse, fracture and possibility of leakage. The materials selected were hard burned, re-pressed brick, Portland cement imported from England, and clean river sand. The design was based on the consideration that in each case the pressure exerted from the head of water to be retained was in one direction. The bulkheads were, therefore, erected in the form of an arch set against footings cut into the solid rock, footings also being cut into the roof and floor of the workings to remove loose or fractured material and make a perfect seal against leakage at point of contact between brick work and walls of drift. The first arch was re-inforced by a second arch of similar design and the space between the intrados and extrados of the two arches filled with strong cement concrete. The extrados of the final arch was also sealed by strong cement concrete faced with two-inch cedar plank. The strongest and most perfectly shaped brick were chosen for the construction of the main arches, and the mortar used consisted of two parts sand to one cement, freshly mixed as required. A vertical section of the bulkhead is shown. A three inch wrought iron pipe was laid through each bulkhead to carry off water accumulated during construction.

POPLAR CREEK AND OTHER CAMPS OF THE LARDEAU DISTRICT

BY R. W. BROCK

(VOL. VII, pp. 87-111.)

The mining camps specifically referred to are those of Fish River, Ferguson and Poplar Creek. The more important mines in these areas are described. In the nature of the rocks and the character of the ores, the Lardeau, the author states,

has many points of resemblance to the Slocan district. Three more or less clearly defined zones of mineralization may be recognized: First, a southwestern belt on the slope to the southwest of the main valley traversing the district; second, a somewhat sharply defined central belt commencing at Fish river and extending southeastward to Poplar Creek; and third, the lime dyke belt, along the Lardeau-Duncan divide. The ores occur prevailingly in the phyllites, to some extent in the limestone, and in places in the rusty weathering diabase schist. The mineral zones are, in common, characterized by the presence of bands of stratified rocks and the occurrence of dykes of the diabase schist, by which indeed the zones may be recognized. The veins which usually occur near, along or within these dykes, have largely the characters of the composite fissure type. They have been filled by aqueous mineralizing solutions. The deposits may have a relationship to the pegmatites, accompanying the granite intrusion. According to economic mineral contents the veins may be divided into two groups, the silver-lead vein, rich in metallic sulphides; and the gold vein, poorer in sulphides, but carrying free and combined gold. The values are not evenly distributed, but are localized in chutes. There is every indication that the veins are as persistent at depth as they are horizontally. The author concludes with some suggestions respecting localities in which prospecting might be advantageously undertaken.

THE MINES OF ONTARIO

By W. E. H. Carter

(Vol. VII, pp. 114-167.)

The author deals very comprehensively with the history, development and progress of the several mineral industries of Ontario, including gold, silver, copper, nickel, iron, lead and zinc, pyrite, corundum, graphite and mica. Briefer reference is made to other and minor industries, such as the mining of molybdenum, platinum, feldspar, gypsum, actinolite, talc and asbestos.

THE STUDY OF STRATIGRAPHY

By W. A. Parks

(Vol. VII, pp. 168-174.)

The author submits a plea for the more extended investigation in this particular branch of geological science. He shows that the major portion of the mineral wealth annually won in Canada is derived from the Paleozoic and other stratified rocks; but remarks that there is a growing tendency to disregard enquiry into the conditions surrounding those deposits associated with stratified rocks, which general attitude is reflected on the councils of those in charge of the government surveys, while in the curricula of our institutions of learning, there are main courses in mineralogy, petrography, ore deposits, etc., while the minimum attention is given to stratigraphical and paleontological studies. The reason of the tendency to neglect stratigraphy is explained by the fact that many of the deposits contained in the stratified rocks are so easily obtained that at first sight it would appear that the geological conditions are of less importance than in the Archean areas. The fallacy of this point of view is indicated. There is, however, a second and more important reason for the neglect, namely, that the study of the stratified rocks cannot be carried on without the assistance of the study of paleontology. Referring to Ontario only, it is stated that since the time of Sir William Logan practically nothing has been done in that province to establish in detail the Paleozoic rocks of that province.

SOME RECENT ROCK MOVEMENTS IN THE LAURENTIAN AND HURONIAN AREAS

By S. Dillon Mills

(Vol. VII, pp. 177-184.)

The author remarks that a not uncommon idea has arisen that the period of instability of the earth's crust has long passed away, and that since the glacial period, at all events, no movements other than those of volcanic origin have taken place.

He states, however, that since commencing the study of the Laurentian and Huronian districts of Ontario, a contrary conviction has been forced upon him, as regards even these "most solid areas of the earth's surface," and he records the result of observations in Haliburton County and in Gladstone and Patton townships, Algoma, indicative of rock movements in these localities.

THE RELATIVE ATTRACTION OF SOME COMMON MINERALS FOR RESIDUUM OIL

By J. F. HAMILTON, Student.

(VOL. VII, pp. 185-188.)

The result of tests are here presented showing the relative attraction between oil and some of the minerals likely to be most affected by the oil concentration process. These include pyrrhotite, pyrite, mispickel, chalcopyrite, galena, zinc blende, hematite, magnetite, etc.

RATE OF SOLUTION OF GOLD IN POTASSIUM CYANIDE

By T. H. PLUNKETT, Student.

(VOL. VII, pp. 192-193.)

The author records the result of experiments to determine the effect of cyanide solutions on particles of gold of varying size. The effect, it was found, varied greatly with the manner in which the solution is applied, and it is noted that agitation, and agitation aided by heat, have a decided advantage over the percolation process, while agitation aided by heat yields better results than agitation alone. The paper is discussed by Mr. William Thompson, who takes the opportunity to describe the Hendry process for the treatment of heavy sulphide ores.

TREATMENT OF THE DRY ORES OF THE SLOCAN

By T. W. CAVERS, Student.

(VOL. VII, pp. 199-201.)

The ore is described as quartz, with values, chiefly as silver sulphides, scattered in very fine grains in the interstices. It is stated to be too low grade to pay for smelting, and a leaching or concentrating process that would afford "a fair extraction and would either treat all of the ore as mined or the waste material from the hand sorting," is advised as a means for recovering values lost in ore of medium grade, a large proportion of which is discarded. The result of experiments, particulars of which are given, lead the author to believe that the ore may be profitably treated by a combination of oil concentration and cyanidation.

NOTES ON SOME DEPOSITS IN THE EASTERN ONTARIO GOLD BELT

By C. W. KNIGHT, Student.

(VOL. VII, pp. 210-242.)

The area is some seventy miles in length and varies in width at different points. The belt is continuous through the counties of Peterborough, Hastings, Addington, Frontenac, and, to a small extent, Lanark. The author devotes chief attention to describing the geology of the Belmont lodes in Peterborough county, Belmont township; to the description of a vein, known as the Star of the East, in the township of Barrie, Frontenac county; and to a briefer account of the Boerth mine, in the township of Clarendon, in the same county. The difference in the physical characteristics of the two first mentioned ore bodies is specially emphasized.

ON A MINERAL CONTAINING "RADIUM" IN THE PROVINCE OF QUEBEC

BY J. OBALSKI

(VOL. VII, pp. 245-251.)

The author refers to having found in a mine in the Saguenay district a remarkable specimen, which he identified as "Cleveite." This specimen has a specific gravity of 8.43, and weighs 375 grammes, or about 13 ounces. It is well crystallized in a dodecahedron form, thus belonging to the isometric system, and contained 70.71 per cent. of uranium oxide. It affected strongly photographic plates and had a well marked action on the electroscope. A carbonaceous material from the same locality yielded on analysis: Volatile matter, 40.185; fixed carbon, 52.590; ash, 7.225. The ash was found to contain 35.43 per cent. of uranium. The white mica vein from which these specimens were obtained, occurs near the lake of Pieds des Monts, about 18 miles from Murray Bay, in the county of Charlevoix, on the north shore of the St. Lawrence river.

THE EXPLORATION OF THE ONTARIO IRON RANGES

BY A. B. WILLMOTT

(VOL. VII, pp. 257-265.)

The opinion is expressed that correct methods have not been employed for the discovery of iron deposits in Ontario and Quebec. The geographical distribution of the iron ranges is noted, and reference made to the geological characteristics. Favourable and unfavourable indications are shown to be: (1) An impervious basin of schist or greenstone surrounding and underlying the iron foundation. (2) If the basin is in the form of a pitching trough, it is still more favourable. (3) The crossing of the iron formation by a dyke. (4) Contact planes,

either within the formation, or between it and other formations. (5) The more broken and crumpled the jasper and chert the better. (6) The less the amount of iron in the banded jaspers on the surface the better the prospect of finding ore in the bottom of the basin. (7) The presence of any carbonate of iron is an unfavourable sign. (8) The presence of impervious layers of slate, etc., in the iron formation is unfavourable. (9) The points where the iron ranges cross low ground are the most favourable. (10) The presence of magnetite is an unfavourable indication.

On the assumption that a given area is to be prospected for iron the author advises: (1) Determine the geological boundaries of the respective formations, particularly of the lower Huronian. (2) Cross the latter, at right angles to the strike, at intervals of a mile. Wherever any indications of the iron ranges are found this interval should be reduced to one quarter of a mile. The valleys of streams should be examined for boulders of iron and of banded jasper. (3) The iron range found, an accurate geological and topographical map should be made. (4) Surface stripping should be undertaken while the map is in progress. (5) If an ore body is not found and the indications are favourable, deep work must be undertaken. (6) The location of the holes is of prime importance. The first are naturally directed to finding the ore; the succeeding ones to determine the quantity. Vertical holes, parallel or nearly so with the bands of jasper, are to be avoided.

MAGNETIC SEPARATION

By F. T. SNYDER

(VOL. VII, pp. 270-277.)

The history of magnetic separation is traced. It is shown that the really important development has taken place in the last twenty years, when the question of magnetism had come to be relatively well understood in connection with the design of dynamo machinery, so that it is possible to build a separator that will handle practically all materials, the limit being that

the more difficult the material is to handle, the greater will be the cost of the machine, and consequently the less return commercially. So well, it is added, has the principle of the design of a magnet separator come to be understood that a difference of magnetic susceptibility now offers a cheaper way of concentrating minerals than the customary method of taking advantage of differences in specific gravity. Brief reference is made to the separation of iron and of zinc; while the utilization of the method for the cleaning of corundum is specially emphasized.

NOTES ON THE OCCURRENCES, PRODUCTION AND USES OF MICA

By E. T. CORKILL, Student.

(VOL. VII, pp. 284-303.)

The three principal mica producing countries, in their order of importance, are shown to be: (1) British India; (2) Canada; and (3) the United States. The occurrences are described, and the origin of pegmatite dykes discussed. A quotation is given of the laws, propounded by Mr. J. A. Holmes, for the occurrence of deposits of commercial mica. The concluding section of the paper is occupied with an account of the methods of mining this mineral.

THE CHLORINATION OF GOLD ORE OF THE NORTH BROOKFIELD MINE, NOVA SCOTIA

By H. L. FORBES, Student.

(VOL. VII, pp. 308-317.)

The ore here consists of quartz, slate and quartzite, mineralized with mispickel, pyrite, some galena, zinc blende and malachite. It is first crushed in a stamp mill, then concentrated, and the concentrate, (containing approximately 30 per cent. of the gangue and the remainder sulphurets) subjected to chlorination. The plant and practice are described in detail.

A FEW FEATURES OF MINING IN THE REGENT GROUP OF MINES, NEGAUNEE, MICH.

By M. B. ATKINSON, Student.

(VOL. VII, pp. 319-334.)

The features noted are the methods of working, including drilling, blasting and mining; and the basis on which miners are paid for contract work. The ore is a hematite of a medium hardness, and is divided into Bessemer and non-Bessemer. Standard ore is: iron, 63 per cent.; phosphorous, 0.045 per cent.; and water 10 per cent. If the phosphorous exceeds this percentage the ore is classed as non-Bessemer.

THE PIONEER IRON MINE, ELY, MINN.

By E. J. CARLYLE, Student.

(VOL. VII, pp. 335-367.)

The Pioneer is one of the many mines on the Vermilion range operated by the United States Steel and Iron Corporation. The geological conditions here and the methods of mining the ores are very fully detailed by the author.

NOTES ON THE BRITISH COLUMBIA ZINC PROBLEM

By ALFRED C. GARDE

(VOL. VII, pp. 368-373.)

The carbonates and galena ores of the Slocan district while usually free from zinc at the surface, as a rule carry a considerable percentage of this mineral as depth is attained. The result of the

steadily increasing percentage of zinc in ore consigned to reduction works, caused the smelters to penalize zinc to the extent of 50 cents per unit on galena containing more than 10 per cent. of zinc. Since the zinc contents in spite of close hand sorting could not be kept within this limit, mechanical concentration by water was applied, and while the system employed left much to be desired in respect of efficiency, the aim of keeping the galena contents within the zinc penalty limit was attained; but at an enormous waste since as much as the zinc as possible was sent through the tail-races. To conserve and utilize the zinc became the object of the author, who introduced magnetic separation into the district, by erecting a plant at the Payne mine. His example was followed by other mine managers.

UNDEVELOPED MINERAL RESOURCES OF ONTARIO

BY WILLET G. MILLER

(VOL. VII, pp. 377-392.)

The aim of the author is to roughly outline the opportunities awaiting the prospector in this field. After briefly touching on the possibilities of the occurrence of minerals of economic importance in the plutonic and metamorphic rocks of the Laurentian system, which heretofore have been but lightly regarded, the subject is considered under a number of heads, namely: (1) Metals and their ores; (2) Minerals used for grinding and polishing; (3) Refractory materials; (4) Minerals used as pigments; (5) Gem stones; (6) Minerals used in certain chemical manufactures; (7) Minerals used in agriculture; (8) Fuels and illuminating materials; (9) Materials for brick, pottery and glass; (10) Cement and (11) Stone. It is clearly shown that the opportunities for mineral exploration in Ontario are not only promising, but boundless.

A NEW AREA OF COPPER-BEARING ROCKS IN THE EASTERN TOWNSHIPS OF THE PROVINCE OF QUEBEC

By JOHN A. DRESSER

(VOL. VII, pp. 397-399.)

Of the three areas of pre-Cambrian rocks, mapped by the Geological Survey, the western and central belts have long been known to be copper-bearing, having, in fact, yielded practically all the copper yet produced in the province. Of the third pre-Cambrian area, that around Lake Megantic, little is known. During the summer of 1902 the author spent a few days in an examination of the rocks in the vicinity of Lake Megantic, and noted examples similar to the copper-bearing rocks of Ascot. Other testimony is also offered. Topographically considered, this area, it is stated, seems to be a northern extension of the copper-bearing range of the vicinity of Berlin Falls and Copperville, in New Hampshire.

ON THE NICKEL DEPOSITS OF NORWAY

By R. G. LECKIE

(VOL. VII, pp. 401-408.)

The similarity of the older geological formations of Norway to those of Canada is noted. In the pre-Cambrian and Cambro-Silurian, deposits of copper, nickel and cobalt occur. The copper mining industry of Roros dates from 1646, and the mines are still being actively operated. The nickel deposits, each of which is described, are found on the Island of Ostero, at Fieldskulnaes, on the Island of Foeoe, and in the south of Norway. Ostero Island is traversed by ridges, rising occasionally to a height of 1,500 feet, and composed of syenite, mica schist, hornblende schist, gabbro and diorites. Over a length of five miles, interbedded masses and lenses of pyrrhotite are found, subordinate to the stratification. The ore from one locality is said to have assayed 2.35 per cent. nickel and 1.02 per cent. copper. At the

Evje mine, in southern Norway the geological formation is very similar to that at Ostero and Foeoe. The schists are tilted to a high angle and by contraction or lateral pressure have become corrugated, the corrugations being at right angles to the strike. The openings produced in the foliation have become filled with iron sulphides carrying nickel and copper. The ore deposits form, therefore, a series of lenses, more or less connected. The ore is said to average from 3.30 per cent. to 4.05 per cent. nickel, and from 1 to 1.30 per cent. copper. Cobalt is also present, showing as high as 0.50 per cent. The mines of Ertelien, Langedal and Stoverntangen have furnished the smelting works at Vaeleren with over 50,000 tons of ore, the average contents of which was 2.10 per cent. nickel, and 1 per cent. copper. The cobalt mines at Skuterud and the nickel mines of Askim are also briefly described. In conclusion it is remarked that although there are in Norway many extensive bodies of pyrrhotite carrying nickel and cobalt, yet they are too scattered and too low grade to successfully compete with the great mines of Sudbury and of New Caledonia, under present conditions.

ON THE OCCURRENCE AND DEVELOPMENT OF CORUNDUM IN ONTARIO

By M. B. Baker

(Vol. VII, pp. 410-421.)

Ontario is stated to possess the largest, purest and practically the only productive deposits of corundum in the world. The discovery of the mineral and the subsequent development of a local industry is noted. Corundum is found in Ontario in four associations: (1) In crystalline limestone; (2) in anorthosite; (3) in nepheline syenite; and (4) in pink syenite, the most important mode of occurrence, economically considered. The uses of corundum are mentioned as being as gems for various purposes, and as abrasives. As an abrasive, corundum is used in three forms; 1st, as wheels or stones; 2nd, as corundum paper; and 3rd, as corundum powder.

NOTES ON SOME WESTERN COALS

By J. C. GWILLIM

(VOL. VII, pp. 421-424.)

A common impression has prevailed that the coal beds of the plains and mountains in Western Alberta and Eastern British Columbia are of the one period and that the varying qualities of the coals from low grade lignite to anthracite are due to changes induced by the proximity of the mountains. The author disproves this, and shows that the respective coals belong to distinct periods, and are, probably different in origin, as Lower Cretaceous, Belly River and Laramie in upward succession. The Lower Cretaceous coals are those found in areas within and closely adjacent to the main range of the Rocky Mountains; the Belly River series outcrops some distance east of the foothills, as at Lethbridge; while the Laramie is a later period, superimposed in large patches upon the foothill country, between the Belly River and the mountains. Considering these coal series as being of distinct periods and of original organic difference, it is shown that the chief factor in producing true coal is that due to differences in geological age and condition. Thus the lignite remains a lignite, but of improved quality, and the volatile matter in bituminous coal falls (occasionally) to as low as from 6 to 10 per cent. as a result of local influences.

MINERAL PRODUCTION OF ONTARIO IN 1903

By THOS. W. GIBSON

(VOL. VII, pp. 425-430.)

The author reviews and presents statistics of the mineral industry of the province for the year, 1903.

THE GEOLOGICAL SURVEY OF CANADA AS AN EDUCATIONAL INSTITUTION

BY T. L. WALKER

(VOL. VII, pp. 435-442.)

It is pointed out that from the beginning the Geological Survey of Canada has been an educational institution. Of late, however, it has failed to regard the training of geologists as one of its functions. It is urged that students at the universities be permitted to accompany field parties in order that they may gain experience of field conditions, a course of training that the colleges are unable to provide.

SUGGESTED IMPROVEMENTS TO THE MINING LAWS IN CANADA

BY EUGENE COSTE

(VOL. VII, pp. 450-466.)

The two main suggestions are: (1) The necessity of provision for the performance of annual assessment work on all mineral lands in Canada, such work to be equivalent, it is suggested to a rate of expenditure of $5.00 per acre; and failure to perform such work should be penalized by forfeiture unless the money equivalent, at the rate of $5.00 per acre per annum, be paid to the Crown. (2) The enactment of a "Mines Act" by the Parliament of Canada.

The author summarizes the mining regulations of the Dominion and the mining laws of the provinces, and calls attention to certain anomalies, more especially as regards the provisions for assessment work as required for placer claim holdings as compared with the less stringent requirements in respect of quartz claims. The instability of existing conditions in the absence of a statuary enactment for the regulation of title to mineral property under Federal jurisdiction, is noted.

ACID MAKING FROM PYRRHOTITE

By Ernst A. Sjostedt

(Vol. VII, pp. 480-494.)

The author describes the plant erected under his supervision at Sault Ste. Marie for the manufacture of sulphuric acid from pyrrhotite. The plan proposed for utilizing the sulphur in this ore was to roast the pyrrhotite in a closed furnace, and to use the resulting sulphur dioxide gas, after it has been purified and cooled in (1) the manufacture of a "bisulphite liquor" suited to the requirements of the pulp industry; (2) in the manufacture of liquid sulphurous anhydride; and (3) in the manufacture of sulphuric acid of three grades of strength. Data are given to prove that not only can the pyrrhotite be roasted without the aid of a special fuel, but also made to yield a sufficiently strong SO_2 gas for the sulphite pulp industry, for liquefaction and for the manufacture of sulphuric acid, "thereby giving to this much neglected mineral a value and an opportunity which it never had before."

THE EARLY HISTORY OF MINING IN THE SUDBURY DISTRICT

By J. W. Evans

(Vol. VII, pp. 495-499.)

Nickel was reported by the Geological Survey of Canada, as having been discovered in the Sudbury District as early as 1853. It was not until the advent of the Canadian Pacific Railway in the district that attention was paid to its mineral resources. The author traces the history of the nickel industry from 1884, the year of its inception, to 1890, by which date operations on a considerable scale were in progress.

NOTES ON THE SPECIAL FEATURES OF COAL MINING IN THE CROW'S NEST, B. C.

BY JAMES MCEVOY

(VOL. VII, pp. 500-504.)

A comparison is drawn between "Eastern" and "Western" coals. The former are practically all of Carboniferous age; while the Western coals belong chiefly to the Cretaceous formation and consequently are four geological ages younger than the coals of the East. They have gone through the same stages as the Eastern coals, but their development has been accomplished in about half the time. Their process of development is described. In the Crow's Nest Pass, active mining operations are carried on at Morrisey, Fernie and Michel. At Coal Creek, the oldest of these collieries, the upper seams lie in attitudes varying from horizontal to a dip of 15 degrees. The lower seams on the same creek dip as high as 20 degrees. At Morrisey the dips vary from 8 degrees to 24 degrees; and at Michel from 15 degrees to 35 degrees. In cases where the dips are moderate the equipment is simple, like that for a flat seam; with the steeper dips incline planes are used, on which gravity does the work of lowering the cars from the working places to the main haulage roads. Where the dip approaches 35 degrees, chutes are used in the rooms, and the coal is drawn from these into cars on the levels. Other features are explained. The physical and chemical properties of the coal are mainly affected by the pressure that has been exerted by the bending of the measures and by the manner in which the strata have yielded to the bending movement and analyses are presented demonstrating these effects. Usually when the roof and floor have held the coal under intense pressure during the bending movement the coal remains firm.

EXHAUST STEAM BOILER FEED WATER HEATERS

HOT WATER PUMPS AND PUMPING

BY W. D. L. HARDIE

(VOL. VII, pp. 505-530.)

The author discusses various questions of a practical nature in connection with the subjects. Of the two classes of feed water heaters, the closed heater, he remarks, if used simply for heating pure water by radiation, will yield satisfactory results; but in the case of impure water the heater will not remove the impurities nor prevent the formation of scale in the boilers. Descriptions are given of a few of what are described as being the best open exhaust heaters on the market.

THE GOLDFIELD DISTRICT, NEVADA

BY E. P. JENNINGS

(VOL. VIII, pp. 39-45.)

The first locations in Goldfield were made in the summer of 1903, and the first rich ore was discovered in the autumn of the same year. The author outlines the physical, topographical and geological conditions. The country rock of the mineral veins is rhyolite, and contains all the minerals so far found. The quartz lodes are altered rhyolite, which has been more or less completely converted into a jasper-like quartz, with no indications of a vein structure, and no well defined boundaries, but gradually fading into the rhyolite. These lodes carry from traces to a few dollars in gold, very irregularly distributed. The rich ore occurs in irregular seams, small breccia zones, and lenticular shaped cavities in the jasper reefs. The author infers that the formation of the quartz lodes and the subsequent deposition of the ore can best be explained by the action of descending waters acting under the well known laws of metamorphism.

WROUGHT PIPE—THREADING AND RELATIVE DURABILITY OF STEEL AND IRON

BY FRANK N. SPELLER

(VOL. VIII, pp. 46-55.)

The first section of the paper is occupied with a discussion on the relative resistances of wrought iron and steel to corrosion, and the results of tests and other data are presented to show that no important difference exists between iron and steel, although the variable effect of different conditions is more marked. The second section of the paper deals with pipe threading. The superiority of steel over wrought iron pipes, and of a soft steel welded joint over one made of wrought iron is indicated.

THE ADVANTAGES OF COMBINING TOPOGRAPHICAL WITH GEOLOGICAL SURVEYING IN UNEXPLORED REGIONS

BY ROBERT BELL

(VOL. VII, 56-58.)

The author's main argument in favour of this practice is that the cost of making "anything like a complete topographical survey of Canada would be immense, and the time required would be too long for the geologists to wait, even if they followed in the footsteps of the topographers as rapidly as their work proceeded. The people of Canada want a preliminary knowlegde of the geology of this country as soon as possible, and this may be obtained only by the system heretofore followed."

CRUDE PETROLEUM AND ITS APPLICATION AS FUEL FOR INDUSTRIAL OPERATIONS IN THE HAWAIIAN ISLANDS

BY J. N. S. WILLIAMS

(VOL. VIII, pp. 59-67.)

The crude oil, brought from California, is used as a fuel to replace coal on locomotives and for numerous industrial purposes. It is much more economical. Coal in the Hawaiian Islands costs from $6.00 to $10.00 per ton. One hundred and sixty-eight gallons of California crude oil is taken to be equal in calorific value when burnt in the usual type of furnace under ordinary boilers, to 2,240 lbs. of average coal. The cost of oil delivered to the furnace averages $3\frac{1}{2}$ cents per gallon. One pound of the coal, as used, and with average skill in firing, will evaporate to steam at ninety pounds pressure 7.75 lbs. of water. One pound of oil, burnt in burners that are described, will evaporate to steam at the same pressure from 12 to 14 pounds of water; and, roughly stated, 6 lbs. of average crude oil are equal in heating power, under average conditions, to 10 lbs. of average coal. The author describes fully the methods in use here for storing and burning this class of fuel.

THE NEED OF A PROVINCIAL MUSEUM IN ONTARIO

BY W. A. PARKS

(VOL. VIII, pp. 68-73.)

In advocating the establishment of a provincial museum at Toronto, the capital of Ontario, the author would have it embrace the entire field of human activity and all branches of geological and biological science. A museum serves three functions: The first in providing material for the special in-

vestigator, the research student, the savant; the second, in presenting the natural history of the country to the eye of the college student and of the people in general; the third, the effect produced by the contemplation of the best in any given line of exhibit. To these, the author adds a fourth function; that of downright utility to the miners and manufacturers. He concludes with the remark that while his plea is for a provincial museum in Ontario, the arguments advanced apply with equal force to the needs in this respect of the other provinces.

THE ARTESIAN AND OTHER DEEP WELLS ON THE ISLAND OF MONTREAL

By Frank D. Adams

(Vol. VIII, pp. 76-97.)

A general statement is presented summarizing the results of investigations carried on by the Geological Department of McGill University from data obtained of artesian boring on the Island of Montreal. Before, however, considering these records, the author reviews some of the conditions by which the occurrence of underground water is affected.

Among the general conclusions reached are: that apparently there is no distinct water-bearing horizon on the Island in the form of interstratified permeable beds; the water passes through the limestone series in large volume, following underground channels which have the form of irregular fissures; the source of the underground water is in all probability the higher portion of the plains along the flank of the Laurentian country, in the northwestern part of the geological map-sheet. Respecting the chances of obtaining water by boring in the neighbourhood, it is calculated that water will be encountered in seven out of nine wells drilled; but if a boring be made to a depth of 750 feet without obtaining water, it is advisable to abandon the hole.

NOTES ON CONCRETE

By R. W. LEONARD

(VOL. VIII, pp. 102-110.)

Concrete made from hydraulic cement is alone here considered. The standard specifications are: A maximum residue of 10 per cent. shall be retained on a sieve of 10,000 meshes per square inch, and the whole of the cement shall pass through a sieve of 2,500 meshes to the square inch. The specific gravity shall be between 3.09 and 3.25 for cement not over two months old. The neat cement shall bear a strain per square inch at 3 days of 300 lbs.; 7 days, 400 lbs.; 28 days, 500 lbs. The author considers these specifications somewhat lenient. A method of testing for soundness is described; the qualities of sand and stone used for concrete mixing are discussed; and materials that may be most advantageously and economically employed, such as coarse gravel in place of broken stone and the superiority of coarse pit sand over crushed quartz, under certain conditions, considered. The author also deals with the application of concrete in mining, and further shows that it is quite possible to make concrete water-tight.

VALUE OF UNDEVELOPED MINING CLAIMS

By G. R. MICKLE

(VOL. VIII, pp. 111-117.)

The author endeavours to ascertain whether it is possible to determine the value of an undeveloped claim mathematically on the basis of averages. He points out that the same methods applicable to insurance on the basis of averages cannot be applied to mining; but from certain calculations he concludes that the prices commonly asked for undeveloped claims in this country are too high and recommends that purchases be made on long options without cash payments.

THE ELECTRIC SMELTING OF ZINC ORES

By FREDERICK T. SNYDER

(VOL. VIII, pp. 118-131.)

The author notes that in treating a lead ore containing zinc, the common practice at the average smelting plant is to waste as much of the zinc in the slag as is technically practicable. The practical limit to the amount of zinc that can be slagged off is about ten per cent. If more zinc than this is put into the charge a portion of it will be reduced to the condition of metallic zinc, which will be volatile at the furnace temperature, and meeting the oxygen of the blast, is oxidized to zinc oxide. This being infusible, accumulates in the furnace, clogs it, and stops the process of smelting. If it were not for the oxygen of the blast, both metallic lead and metallic zinc might be produced at the same time. The heat needed to smelt a charge is usually obtained by the combustion of coke inside the furnace. If, however, the coke were burned outside the furnace, and the resulting heat separated from the gaseous products of combustion and transferred within the furnace, the volatilized zinc would not meet the blast, and escaping oxidation, might be condensed and removed in metallic form. This might, the author suggests, be accomplished by electricity. The use of electricity in this connection is discussed and the author also presents a series of calculations, reducing to figures the costs and other data relative to the subject.

ELECTRIC SMELTING

By EUGENE HAANEL

(VOL. VIII, pp. 132-154.)

The author epitomizes the work done by two commissions appointed by the Dominion Government to investigate the different electro-thermic processes for the smelting of iron and the making of steel in operation in Europe, and describes the Ruthenburg, Keller, Heroult and Stassano processes. He points out that Canada is at present largely dependent upon outside sources

for iron in the crude and manufactured states; that there are large resources of iron ore in the country; that the conditions are such, however, that the necessary coking coal for blast furnace work is found only in the extreme east and west, while the Provinces of Ontario and Quebec, possessing numerous and extensive deposits of iron ore are without coal deposits. Thus if these iron resources are to be utilized in the production of pig by the present methods of smelting, either coke must be brought to blast furnaces erected in the vicinity of the iron deposits, or the ore of these provinces must be transported to blast furnaces erected near an abundant coal supply. In either case the transportation costs render such a course uneconomic. The solution of the problem would be afforded by the introduction of electric smelting. The author states: "There is no question in my mind that we are on the eve of great achievements as regards the application of electric energy to the extraction of metals from their ores and that the energy of the splendid, abundant and as yet undeveloped water powers of Canada will ere long be employed for metallurgical purposes."

CANADIAN METALLURGICAL PRODUCTS FOR THE FAR EAST

By Frederick Hobart

(Vol. VIII, pp. 158-160.)

Canadian mineral producers are advised to consider the Far East—China, Japan and India—as a possible market for, especially, copper, lead, iron and zinc. It is added that there is also a large market for iron in Australia.

MINING STATISTICS

By Frederick Hobart

(Vol. VIII, pp. 162-167.)

The figures of production in all metals have an important bearing on trade. To know what has been done in a given period, and to know it as early as possible is of chief importance to the

practical worker. Thus the approximate return of output for a given year, or other fixed period, attainable (say) two or three months after the close of that period, is far more valuable than the exact returns published ten months or a year later. Accessible at the earlier date they serve as a guide; later their value is historical. As regards the question of valuing production, the prices obtaining at commercial centres is advised as the basis; but the rule chiefly to be observed is to fix a standard and then adhere to it as closely as possible. The author also offers some suggestions on the compilation of statistics.

ON UNIFORM MINING STATISTICS IN CANADA

By EUGENE COSTE

(VOL. VIII, pp. 169-171.)

The advantages of uniformity in methods of presenting mining statistics as issued annually by the several provinces of the Dominion, are indicated; and the author suggests the use of two tabulated statements one recording the first marketed products of all mines, quarries and concentrating mills, by quantities valued at the place of production; and the other recording the quantities of metallic or other manufactured products from smelting, metallurgical, chemical or other works, as finally produced with their market value at the works.

BORNITE ORES OF BRITISH COLUMBIA AND THE YUKON TERRITORY

By WM. M. BREWER

(VOL. VIII, pp. 172-180.)

"The several occurrences of well-defined contact deposits of bornite ore at various localities throughout western British Columbia and the Yukon Territory present many characteristics which make a study of them peculiarly interesting." The localities are very widely separated but the geological conditions

in each are very similar. The occurrences to which specific reference is made are those on Texada Island; Gribbel Island; two localities (Sydney Inlet and Ladysmith) on Vancouver Island; Copper Mountain, Similkameen district; and White Horse, Yukon Territory. The ore bodies are usually found at the contact between limestone and a so-called felsite; and rarely between limestone and diabase. The ore-bodies are isolated, but are invariably close to zones or belts in which are found deposits of chalcopyrite, pyrrhotite and magnetite. The author believes that the felsite has had a greater influence over the deposition of the bornite ores than any other of the igneous rocks, and he quotes evidences in proof of this contention.

A CORRECTION IN THE CLASSIFICATION OF OUR GOLD FORMATION

By F. HILLE

(VOL. VIII, pp. 183-191.)

The author proposes to correct the two following statements respecting the gold deposits in Western Ontario: (1) "The rocks in which the gold veins occur belong to the Archean age. (2) The fissures in which the gold is deposited are pinched by lateral pressure and are not true."

THE DISTRIBUTION OF THE PLATINUM METALS IN OTHER SOURCES THAN PLACERS

By CHARLES W. DICKSON

(VOL. VIII, pp. 192-210.)

A brief historical account of platinum is followed by a reference to the sources of the supply of the metal. In each instance the platinum is obtained exclusively from placers.

Since the first discovery of platinum, however, attempts have been made frequently to trace it back to its original source. In many cases the search has been largely to satisfy scientific interest; but the necessity for a more complete investigation is urged on economic grounds. In addition to placer deposits, platinum is found in veins (of which several examples are given) and disseminated in eruptive rocks. The most important discovery of platinum in connection with secondary ores was the identification of sperrylite in the heavy concentrate from the gold ore of the Vermilion mine, near Sudbury, Ont. Since then it has been recognized that platinum is generally present in the nickel-copper ores of the Sudbury district, and it is also present in small amounts in the nickel-copper ores of Norway and Sweden, in the covellite ores of the Rambler mine, Wyoming, in a garnet-biotite in North Carolina, and in copper ore. Respecting the occurrence of native metal in eruptive rock, the author refers to Prof. Kemp's conclusions based on his investigations in the Tulameen district, B.C., that the platinum there must occur in some special form of the peridotite or pyroxenite. Prof. Kemp also found traces of platinum in more or less decomposed granite. From this it is deduced that platinum is not confined to basic eruptives. Evidence is also adduced that platinum migrates in solution. The author concludes that proof is already established of the dissemination of platinum in the mother rock, especially those of the peridotite type, and although Prof. Kemp thinks the chances that it will be found in quantities sufficient to mine are not encouraging, yet there is a chance, and to this end a more thorough investigation of peridotites and their decomposition products is advisable, and may lead to important results.

BANKHEAD COAL MINES

By C. M. HENRETTA

(VOL. VIII, pp. 215-220.)

The coal measures here are of Cretaceous age. The formation was raised on the eastern side, and the seams now dip to the westward at an angle of about 50 degrees. The coal in the

southern half of the field is semi-anthracite in the lower seams, while those in the northern portion are semi-bituminous. The author describes the plant and method of working at Bankhead. Since the coal is soft and friable, it is necessary to leave large pillars, the main pillar above the gangways being sixty feet thick.

THE STRATIGRAPHY OF THE CASCADE COAL BASIN

By D. B. Dowling

(Vol. VIII, pp. 221-233.)

Previous to the uplift of the Rocky Mountains all that part of the continent had for ages suffered but little from earth movements, except, perhaps, a shallowing of the sea from Carboniferous times. There is little if any deposit to mark the lapse of time between the Carboniferous and the earlier stages of the Cretaceous, but the succession of the beds indicate no physical break. During most of the Cretaceous age the sea apparently never had any great depth. Later there were fresh water inundations, causing probably large lakes in which were deposited the Tertiary beds of Alberta. The shallow water periods of the Cretaceous also show intervals of emergence during which land conditions prevailed and vegetation flourished. As the elevation of the land was not greatly above the sea, frequent inundations followed and the vegetation was covered, to be gradually changed to coal beds. There are, therefore, three horizons that may be regarded as coal-bearing in the Cretaceous. These are the lower part of the formation, called the Kootenay series; the middle portion of the formation, the Belly River series; and the upper part of the Cretaceous, the Lignite-Tertiary of early nomenclature, but now, (in northern Alberta), known as the Edmonton series. In the present paper, the author discusses the stratigraphy of the area in which the coal belongs to the first mentioned, namely the Kootenay, series. The coal here owes its exposure to the uplift of the Rocky Mountains and is found to the west of the outer break of the range.

NOTES ON THE LIFE HISTORY OF COAL SEAMS

BY J. C. GWILLIM

(VOL. VIII, pp. 235-240.)

The conditions that accompany the semi-bituminous and semi-anthracite coals of Western Canada indicate that they are the result of alteration, chiefly by pressure. Time and original organic differences do not seem to be responsible mainly for the differences in quality. Although the persistency and extent of these coal series are very great, the thickness of any one seam, or, in many cases, the seam itself, is not continuous. The plant growth was more or less continuous over vast areas, but had local increase. These original differences have been augmented by the pressure to which the measures have since been subjected. Analyses are presented chiefly of western coals, ranging from lignites high in water to graphite anthracite as illustrative of some of the author's conclusions.

THE ECONOMICAL TREATMENT OF SULPHIDE ORES

BY C. B. JACKES

(VOL. VIII, pp. 244-258.)

After referring to the great quantities of sulphide ores in Ontario, British Columbia and Nova Scotia, the author states that his attention has been called to a process that seems to offer great possibilities for the economical treatment of ores of this nature, and more particularly in the manufacture therefrom of paints and pigments. Thus by this process, in the treatment of lead ores, the conversion into pig lead is avoided, and the white lead produced directly from the raw ore in a state of purity and smoothness of grain not attainable by any other method. The process is described in detail and a condensation of the specifications leading to the patent granted for Canada to George Edward Kingsley, the patentee of the improved apparatus recommended for use in the process, is appended.

THE BED-ROCK OF THE GILBERT RIVER GOLD-FIELDS, QUEBEC

BY JOHN A. DRESSER

(VOL. VIII, pp. 259-262.)

The conclusion reached is that the placer gold of south-eastern Quebec may be derived in all cases from the same series of volcanic rocks that contain the principal copper deposits of the region. Hence, it would follow that alluvial gold in this region should be looked for only in localities underlain by these volcanics, or in lower parts of the valleys of the streams that traverse, or have traversed, them; and that it may occur in any part of the area occupied by these rocks in which the conditions have been favourable to the formation and preservation of placer deposits. The occurrence of gold, seems, at all events, to be a reliable indication of the proximity of copper-bearing rocks in this district.

A NOTE ON VARIETIES OF SERPENTINE IN SOUTH-EASTERN QUEBEC

BY JOHN A. DRESSER

(VOL. VIII, pp. 267-269.)

The importance of the asbestos and the chromic iron industries renders any information respecting the serpentine rocks, in which these minerals occur, of economic interest. One variety of serpentine found in many parts of Quebec, was shown by Adams to have been derived from a rock of the peridotite class. By extensive alteration, especially hydration, peridotites that are rich in olivine become serpentines. This view of their source has been generally accepted for all the serpentines of south-eastern Quebec. The author, however, has observed some bodies of serpentine, the character of which seemed to indicate that it had a somewhat different origin, and subsequent microscopic investigation led him to believe that it was an alteration product of some very basic phase of a much altered volcanic rock, a variety of porphyrite. How large a part of the Quebec serpentines belong to each type, and whether they are both valuable as sources of asbestos, are the two practical questions involved.

"LOS REYES" GOLD MINES, SOUTHERN MEXICO

By Alexander H. Smith

(Vol. VIII, pp. 272-284.)

The Los Reyes gold mines are situated in the San Miguel Peras district of Oaxaca county, Mexico. The veins are practically flat, and have been worked it is believed from before the time of Cortez and the Spanish conquest. In the upper veins the vein filling is quartz generally mineralized with iron pyrite and marcasite, a little pyrrhotite, calcite and some copper pyrites. The lower veins contain a considerably larger proportion of pyrrhotite, in places, in solid masses. When the present company took over the mines it was known that rich pillars and bodies of ore had been left in the old workings that would not pay to treat by arrastras. These old workings have been successfully mined on the "buscone" system, the busconers receiving from $1.60 to $8.00 Mex. per metric ton. In new work the different headings are contracted at prices ranging from $10.00 Mex. to $40.00 Mex. a meter. The ore is transported to the mill, about two miles distant, by pack-animals at a cost of from 80 to 95 cents (gold) per metric ton. The ore is particularly amenable to amalgamation, and extractions as high as 90 per cent. have been made. The accumulation of old tailing from the arrastras and from the stamp-mill is cyanided. The author points out that in certain respects methods of mining, etc., are, at first sight, decidedly antediluvian; but their adoption, or rather the fact that they are not changed, is fully warranted by conditions as described.

INDICATOR CARDS

By W. D. L. Hardie

(Vol. VIII, pp. 285-289.)

In view of the fact that compressed air machinery is becoming an ever-increasing part of the equipment of a modern colliery, the author considers that interest will attach to some notes on indicator cards based on his own observations. His

comment is directed mainly to consideration of the "air end card," a diagram of an ideal card from the air end being presented, and the significance of the various points and lines are explained and compared with cards taken from compressors in present use.

A CANADIAN DELLWIK-FLEISCHER WATER GAS PLANT

By Ernst A. Sjostedt

(Vol. VIII, pp. 290-301.)

The author describes the plant utilizing this process in use by the Lake Superior Power company. He calls attention to the economy and convenience possessed by water gas when produced on the Dellwik principle. Speaking generally, its advantage consists of a saving in fuel, time, labour and of an improvement in the quality of the work produced, especially where a high and even temperature is required. For cheapness, quickness and excellence of work it offers particular advantages for welding, brazing, soldering, forging, tempering, annealing and smelting of metals; in the manufacture of open-hearth and crucible steel, pipes, steam boilers, car wheels; in glass blowing; china and pottery firing; in the burning of lime, cement and plaster; in calcining, drying, heating and evaporation; for fuel and lighting purposes; and for motive power in engines for diverse purposes.

PROSPECTING IN WESTERN CANADA

By D. D. Cairnes, Student.

(Vol. VIII, pp. 302-315.)

Information is afforded respecting conditions under which prospecting is carried on in Western Canada, and of the equipment necessary.

MINE SURVEYING AS CARRIED ON AT CENTRE STAR MINE, ROSSLAND, B. C.

BY L. HEBER COLE, Student.

(VOL. VIII, pp. 317-335.)

The methods of surveying in use at this mine are very fully described. The methods of note making and keeping are of special interest.

CHLORIDIZING TREATMENT OF NICKEL ORES

BY F. N. RUTHERFORD, Student.

(VOL. VIII, pp. 336-342.)

The author gives an account of laboratory experiments in the chloridization of nickel ores. He concludes that chloride formed by chlorine and nickel oxide first appears at a comparatively low temperature of 375 deg. C., and at 500 deg. C. begins to volatilize and form insoluble compounds. In the case of low grade ores better results were obtained.

NOTES ON GRAPHITE. ITS OCCURRENCES, USES AND PRODUCTION

BY G. C. BATEMAN, Student.

(VOL. VIII, pp. 343-347.)

In addition to the subjects mentioned in the title, a short description is given of operations at the McConnell Graphite Mine, at Oliver's Ferry, Ontario.

NOTES ON REVERBERATORY FURNACE SMELTING AT ANACONDA

By A. McL. Hamilton, Student.

(Vol. VIII, pp. 349-357.)

The progress and development of copper smelting at Anaconda is traced, showing, in particular, the improvements in practice, the increases in grate and hearth areas and economies introduced.

SOLUBILITY OF COBALT-NICKEL ORES IN AMMONIA

By George S. Hanes, Student.

(Vol. VIII, pp. 358-362.)

The adoption of the process of Malzac to the treatment of the nickel-cobalt ores of Ontario is the subject of the author's investigation. This process is based on the action of the oxygen of the air on nickel-cobalt arsenides, or nickel-copper sulphides, in the presence of ammonia. Successful results were obtained in treating a pyrrhotitic ore from Sudbury, a rich nickel arsenide, and a smaltite ore from Cobalt, and on copper-nickel matte.

A NEW MINING DISTRICT IN THE NORTH OF QUEBEC

By J. Obalski

(Vol. VIII, pp. 363-366.)

The district to which attention is here directed is that of the Chibougamau region, of which the author made a reconnaissance. He reports having discovered on a large island, between the two discharges of Lake Chibougamau, an extensive outcrop of quartz showing visible gold, an outcrop of chalcopyrite and another of iron. The occurrence of asbestos on another island is noted; and magnetic iron, it is stated, is widely distributed throughout the section.

PROSPECTING FOR IRON ORE IN THE TORBROOK IRON DISTRICT, ANNAPOLIS COUNTY, N. S.

BY W. F. C. PARSONS

(VOL. IX, pp. 31-34.)

The author describes the methods adopted, by shaft-sinking and boring, to explore for iron in this area. Analyses of the ore from the "Leckie" mine show: Metallic iron, 52 per cent; Phosphorus, 1.15%; Sulphur, 0.02%; Manganese, 0.10%; Insol., 13.5%; Magnesia, 0.30%; Lime, 2.5%.

NOTES ON THE PRODUCTION AND USES OF CANADIAN CHROME

BY W. H. EDWARDS

(VOL. IX, pp. 35-38.)

Chromic iron ore is found in large quantities in the serpentine belt in the Eastern Townships of Quebec, between Disraeli and Broughton. Operations on a commercial scale have, however, been confined to the Black Lake district. Here after the ore is taken from the pit it is sorted, all ore averaging over 40% Cr_2O_3 being put aside as crude and graded as Nos. 1 and 2. The ore falling below this standard is concentrated. During 1905, 8,477 tons of chromite were marketed, chiefly in the United States, where it was used in chemical manufacture, in the manufacture of ferrochrome, and other chrome compounds.

SOME OBSERVATIONS RELATIVE TO THE OCCURRENCE OF DEPOSITS OF COPPER ORE ON VANCOUVER ISLAND, AND OTHER PORTIONS OF THE PACIFIC COAST

BY WM. M. BREWER

(VOL. IX, pp. 39-48.)

Copper occurs as: (1) Bornite accompanied by some carbonates, chalcocite, and at the deeper levels, chalcopyrite, in contact deposits between crystalline limestone and igneous rocks,

usually felsite associated with garnetite. (2) Chalcopyrite, in a magnetite matrix, in deposits of lenticular structure in fissures in the basic igneous rocks. (3) Chalcopyrite, usually in a magnetite matrix, in contact deposits between crystalline limestone, slate or schist, and basic igneous rocks. (4) Chalcopyrite in association with iron pyrites, barite or heavy spar, and a small percentage of lime. (5) Pyrrhotite, carrying low copper values, sometimes in a gangue composed of epidote, garnet, amphibolite, and some calspar, in fissures in basic igneous rocks; or at the contact of crystalline limestone and the igneous rocks. The localities in which these several classes of deposits are found are enumerated and the more important ore bodies described in detail.

NOTE ON WINDY ARM SILVER BEARING VEINS

By R. G. McConnell

(Vol. IX, pp. 49-53.)

This mineral area is described as being one of considerable promise. Silver bearing veins were found in the district by prospectors bound for the Klondike as early as 1900, but the finds attracted little interest at the time. The principal ore-bearing rock is a porphyrite, although veins also occur in the granite and some in the slate. The veins, which are comparatively narrow but exhibit great persistency in strike, occupy clean cut fissures. The gangue is mainly quartz. The silver minerals include native silver, argentite, stephanite, freibergite and pyrargyrite. Lead minerals are represented by galena, and copper by tetrahedrite. The author states that while it is risky to theorize concerning the future of a district at present so little developed, "it is safe to say that the prospects are very encouraging and warrant the belief that some of the larger veins at least will be developed into mines."

THE LOST PACKER COPPER GOLD LODE

By E. P. JENNINGS

(VOL. IX, pp. 54-57.)

This remarkable lode is situated in Loon Creek Mining District, Custer County, Idaho. It occupies a shear zone that has been traced a distance of 5,000 feet, has a minimum width of 30 feet, but is intersected and faulted by intrusive dykes. The ore is chalcopyrite containing from 2 to 20 ounces of gold and small silver values. The high grade ore occurs in well defined shoots, and averages 15 per cent. copper. The lode is said to be a replacement of the more highly brecciated portions of the shear zone, and classed with those metasomatic deposits of the sericitic, copper-gold type as described by Lindgren. The remarkable features of the lode are: the absence of all primary sulphides but chalcopyrite, which is everywhere present; the scarcity of secondary or vein quartz and all common gangue minerals that are directly precipitated from mineralizing solutions. The quartz present was undoubtedly a constituent of the original granite and the chlorite and sericite are derived from the hornblende and feldspar of the same rock.

A NEW MATTE SEPARATOR

By R. R. HEDLEY

(VOL. IX, pp. 58-63.)

In lead smelting the problem of efficiently separating matte from slag is a complex one. The author describes a device successfully used in the lead smelting works of the Hall Mining & Smelting Co., at Nelson, B. C., invented and patented by Mr. Henry Harris, under the name of the Harris Distributor, and combining the essential principles of the Herreshoff forehearth and the Orford syphon-tap.

MORE NOTES ON STAMP MILL PRACTICE

By Courtney de Kalb

(Vol. IX, pp. 64-71.)

The author considers the subjects of screens, foundations, stamp duty, mortar liners, shoes and dies and inside and outside amalgamation. As regards screens, he points out the unwisdom of depending over-much upon the diameter of the screen opening to determine size of pulp, and remarks that height of discharge and quantity of feed water are the best regulators. He regards with disfavour concrete mortar foundations, preferring built up wooden blocks. Stamp duty, he states, is relative. The metallurgist who has not advanced to the point of tolerating the low crushing efficiency per horse-power of the stamp mill for the sake of the extraction by amalgamation which he can make it yield, is in error at the very foundation of his trade. Mortar liners as an adjunct to the mill are not recommended. The longest life, highest duty, and most uniform and economical wear are stated to be obtained by shoes and dies made as follows: dies, with one inch thick base, forged steel, made from open hearth ingots of 0.08% carbon, forged at dark yellow, bases subsequently annealed; shoes, open-hearth 0.06% carbon steel, forged at bright cherry, necks annealed. Other notes of a practical character are made on the bedding of ores, the dressing of plates and on the use of salts with coppery ores.

RARE EARTHS IN PEGMATITE VEINS

By J. Obalski

(Vol. IX, pp. 72-73.)

The author alludes to discoveries of uraninite and monazite in the Villeneuve Mica Mine, on the Lievre river, Que.; of samarskite in the Maisonneuve mica mine, in Berthier County, Que.; and of orthite or allanite, and gadolinite in a mica mine near Lake St. John in the township of Tache, Que.

ON THE NEED OF A TOPOGRAPHICAL SURVEY OF THE DOMINION OF CANADA, PARTICULARLY WITH REFERENCE TO THE DEVELOPMENT OF THE ECONOMIC RESOURCES OF THE DOMINION

BY FRANK D. ADAMS

(VOL. IX, pp. 74-86.)

The Dominion is without "that great national asset which is a prime necessity for the satisfactory and economical development of our natural resources—a topographical map of our country," and is in this respect outstripped by every civilized country in the world. "We are, in fact, like a householder who is engaged in furnishing his house and yet has no adequate knowledge of the number and dimensions of his rooms, and only a most hazy idea of the size and character of the grounds surrounding it." With this introduction the author proceeds to elaborate his argument, indicating what has been done in the direction, the provisions made and methods pursued for topographic mapping in other countries, notably the United States; and the benefits that accrue therefrom. He concludes: "The work of surveying Canada when once done would be a permanent asset to the Dominion, and until such a survey is carried out an enormous amount of duplication of effort and waste of money will take place, all of which could be saved by the construction once for all of a proper topographical map of at least the more settled portions of the country."

ON THE ADVISABILITY OF THE ESTABLISHMENT OF A FEDERAL DEPARTMENT OF MINES

BY H. MORTIMER-LAMB

(VOL. IX, pp. 87-106.)

The author traces the history of the Geological Survey in its relation to the mining industry and concludes that while the Survey has been of immense value in the development of the country, it has not, in recent years, in attention to economic considerations, kept

pace with the growing requirements of the mining industry, and that the information collected has not been reduced to a sufficiently accessible form. The establishment of a separate Mines Branch of the Department of the Interior is probably attributable to the recognition of these facts. The interests of the mining industries of Canada would be best served by the creation of a Federal Department of Mines to include these two branches of the service, whose functions would thus be correlated, systematized and extended, to the avoidance of the duplication of effort now existing.

A CANADIAN DEPARTMENT OF MINES OR GEOLOGICAL SURVEY

BY J. B. TYRRELL

(VOL. IX, pp. 107-111.) 1906

The duties of the Department would be confined to an encouragement of the mining industry, "by publishing detailed descriptions and maps of the known mines and mineral resources of the Dominion; by close investigation in districts where mineral deposits are known to exist; by exploration in unexplored districts; by carrying on such researches in laboratories as might seem advisable in the interest of mining and metallurgical methods, and by seeing that the information so collected is fully distributed among the people, so that they may be brought to properly appreciate and rightly use the knowledge so gained of Canada's mineral wealth." In short, a Government Department or Bureau to advise the Minister of the Interior is necessary; it was clearly the intention of the Act constituting the Geological Survey that it should fill this function. Such a Bureau might be made effective by allowing its officials to invest in mines, or at least with only moderate or reasonable restrictions; by insisting that the officials keep in touch with mining conditions in other parts of the continent or of the world; and by keeping the public informed of the results of the work of the Survey.

THE REVISION OF THE MINES ACT OF ONTARIO

By J. M. CLARK

(VOL. IX, p. 113-114.)

Allusion is made to a possible early revision of the Ontario Mines Act. The author enunciates the principles on which such revision should be based.

YUKON MINING LAW

By J. B. TYRRELL

(VOL. IX, pp. 115-123.) 1906

The author outlines the main provisions of the mining law in force in the Yukon, indicating their advantageous and disadvantageous points.

THE OCCURRENCE OF DIAMONDS IN THE DRIFT OF SOME OF THE NORTHERN STATES

By ROBERT BELL

(VOL. IX, pp. 124-127.)

The region in which diamonds have been found in the drift extends from the southwestern part of Ohio in a north-westerly direction through Indiana, Michigan and Wisconsin, a distance of about 600 miles. Some writers have assumed that the derivation of the stones may be determined by plotting backward the courses of the glacial strike from the places where the different finds have been made, and that the region where these lines would nearly converge would represent the probable locality. On this basis they concluded that the locality was somewhere in Labrador. The author presents a number of reasons for not accepting these conclusions.

SOME LABORATORY EXPERIMENTS IN MAKING STEEL DIRECTLY FROM IRON ORES WITH THE ELECTRIC FURNACE

BY J. W. EVANS

(VOL. IX, pp. 128-133.)

The author presents the result of experiments in the making of steel directly from iron ores in an electric furnace of special design, which he describes. Ores high in sulphur and titanium were successfully treated, as well as magnetic iron sands. The process, the author considers, should solve the problem of the treatment of iron sands, of which there are large quantities both in Quebec and Ontario. These sands, he states, could be dredged and dried, magnetically separated, and conveyed direct to the furnace at a considerable saving in cost over mining and crushing iron ore.

THE EDUCATION OF MINING AND METALLURGICAL ENGINEERS

BY JOHN BONSALL PORTER

(VOL. IX, pp. 143-160.)

It is but a few years since it was possible, and even quite a matter of course, for young men to be granted university degrees in mining engineering without their having even seen a mine; and in other branches of engineering the situation was no less absurd. The "summer school," established some twenty years ago by Columbia University, and adopted (usually as an optional course) by several other mining schools, was the first and most important move in the right direction. This was followed by the equipment of engineering laboratories, and later of special laboratories of ore-dressing and metallurgy, with which every school of standing is now provided. But meanwhile, it is probable that in this country, at least, too great prominence is being given to the technical side of education. How to do a thing is taught rather than why to do it, and, in the stress and rush of filling students with facts, the infinitely more im-

portant business of teaching them to think is almost forgotten. Preparatory to entering the university the student should receive a good elementary training in the usual school subjects, in elementary mathematics and in at least one modern language. Latin is also desirable, and last, but far from least, the student should be able to write English accurately and clearly. The engineering course should then occupy four years, the first two of which may be devoted to advanced mathematics, physics, chemistry, geology, etc., and therewith some elementary shop work and foundry practice. The long vacations should be utilized for further shop experience in works; or, in the case of mining students, for labourer's work underground, and for field classes in surveying. The two final years may then be given to more technical studies. The author elaborates the subject on these lines, describing in particular the course of engineering study at McGill University. Some laboratory notes on trial runs in ore-dressing are presented as an appendix to the paper.

THE TEACHING OF METALLURGY IN COLLEGE LABORATORIES, WITH A DESCRIPTION OF THE METALLURGICAL LABORATORIES OF McGILL UNIVERSITY

BY A. STANSFIELD

(VOL. IX, pp. 180-190.)

The metallurgical laboratories of a university have several distinct educational uses, which are outlined as: (1) The use of furnaces and other appliances to illustrate the lectures; (2) The teaching of fire assaying; (3) The use of metallurgical measuring instruments; (4) in teaching the properties of metals, fuels and refractory materials; (5) In the study of metallurgical reactions; (6) For large furnace runs; (7) To enable students to carry on research work; (8) The laboratories are also useful to the staff; their use tends to prevent the teaching becoming too academical in character. Each member of the staff should be engaged on some research, either on theoretical or practical lines. Outside testing or experimental work should be undertaken

to keep the staff in touch with commercial and technical requirements. Information gained in this way is far more valuable than that obtained at second hand or from books. The author then proceeds to describe the laboratory equipment at McGill University, and to outline the nature of the experiments that have been or may be conducted in the laboratories.

THE COLLIERY MANAGER

By Wm. D. L. Hardie

(Vol. IX, pp. 200-209.)

The colliery manager, it is remarked, who would "count for much" on the American continent now-a-days, must be prepared to assume greater and more arduous duties than his predecessor of twenty-five or thirty years ago was called upon to undertake. This is in consequence of changed conditions. Thus prior to the introduction of the mining machine "the colliery manager could, with a few assistants, handle the operations of a very extensive colliery without undue effort and live comparatively the life of a gentleman." But now concentration of operations and large production necessitate different managerial methods and special qualifications. The author describes some of the requirements and conditions incidental to modern colliery management.

THE INFLUENCE OF VARYING DEGREES OF SUPERFUSION IN MAGMATIC DIFFERENTIATION

By Alfred C. Lane

(Vol. IX, pp. 210-217.)

The grain of igneous rocks depends upon many factors, such as the chemical composition of the molten mass, chemical reactions therein, and the escape of certain constituents by relief

of pressure. The rate of cooling is always an important factor, and other things being equal, the faster the cooling the finer the grain. The rate of cooling, and consequently the grain varies greatly however, in different parts of a cooling sheet or belt, according as the temperature at which the rate of cooling is high or low. This point is illustrated. The importance of superfusion in the history of the development of a magma, and the magmatic concentration which is the first step in the history of many ore deposits, are emphasized.

ON THE PROBABILITY OF FINDING MINES IN NORTHERN QUEBEC

By J. Obalski

(Vol. IX, pp. 218-220.)

Referring to the explorations of Low and Hardman in the Chibougamau district, the author expresses the opinion that the possibilities for successful prospecting between the height of land, or between James Bay and Lake Mistassini, are encouraging.

NOTES ON A DEPOSIT OF NICKELIFEROUS PYRRHOTITE AT MALACHITE POINT

By Armand Moscovici

(Vol. IX, p. 221.)

Malachite Point is situated on Lake Chibogamau, Chibougamau District, Que. Four small veins of pyrrhotite were discovered here, the ore assaying: Copper, 12.03%; Nickel, 0.39%; Cobalt, trace.

THE ORE DEPOSITS AND GEOLOGY OF THE SUDBURY DISTRICT

By Hiram W. Hixon

(Vol. IX, pp. 223-227.)

The author asserts that with the exception of three detail sheets of Snider and McKim townships, all the maps issued by the Geological Survey of this district are inaccurate. Respecting the origin of the ore deposits, he states that there are two classes of contact deposits in the district and all the mines belong to one or the other, namely: (1) Contacts between the greenstone and sediments, and (2) Contacts between greenstone and granite. He disposes of the theory of magmatic segregation by remarking that if these ore-bodies were separations like matte from slag, the line of separation would be a flat surface and sharply defined. This is not the case.

GENETIC RELATIONS OF NICKEL-COPPER ORES

With Special Reference to the Deposits at St. Stephen, N. B., and Sohland, Germany.

By Charles W. Dickson

(Vol. IX, pp. 236-260.)

The economic occurrences of nickel ores are divided into three classes (1) Compounds with arsenic, (more rarely antimony), or with arsenic and sulphur. (2) Sulphur compounds, including pyrrhotites, and pyrite. (3) Oxidized compounds, prevailingly silicates related to serpentine. Since in the different pyrrhotites the percentage of nickel varies widely, these are again sub-divided as (a) associated with more or less chalcopyrite and pyrite, as lenses in acidic gneisses and schists; and, (b) also as lenses but associated with basic igneous rocks usually of the gabbro type, or their metamorphic equivalents. To the latter class of pyrrhotites, the St. Stephen deposits belong. To them a direct igneous origin has been attributed, but from a study of both the Sudbury and St. Stephen deposits, the author holds that the theory of a direct magmatic segregation is untenable, believing rather that the deposits are largely secondary replacements

along more or less crushed and faulted zones, by means of circulating solutions containing ore minerals that have been deposited by a metasomatic interchange with the rock minerals. The study of a somewhat similar deposit near Sohland, Germany, conduced to like conclusions in this case also, by both Prof. Beck and the author. The evidence on which these conclusions are based is afforded by detailed descriptions of the respective occurrences, the relation of the chalcopyrite to the pyrrhotite indicating that it is a later introduction, being noted as being of special significance. The final conclusions are: (1) The deposits are not the result of a direct magmatic segregation from an original magma. (2) The ores are largely of a secondary nature, deposited from circulating solutions, by a metasomatic replacement of the rock minerals. (3) The relation of the rock minerals can only be explained by such a replacement. (4) Where the effects of metamorphism in the crushing and alteration of the rock are most apparent, the largest quantity of ore is developed. (5) The ore has been introduced into the rock after its complete differentiation and solidification. (6) The ore first replaces the rock along planes of brecciation and least resistance, and finally extends till it has replaced considerable masses of the rock. (7) The ore is most prominently associated with secondary non-metallic minerals, namely hornblende and chlorite. (8) The different relations of the magnetite and sulphides to the rock minerals give additional proof that the latter are secondary. (9) Pyrrhotite at first, probably, formed the larger proportion of the ore, and chalcopyrite has been introduced still later. (10) The three deposits of Sudbury, St. Stephen and Sohland are practically identical, the ore-bearing rocks being of the same type, with only minor difference of local development.

ANTHRACITE BREAKER OF THE PACIFIC COAL COMPANY, LIMITED, BANKHEAD, ALBERTA

By Lewis Stockett and B. R. Warden

(Vol. IX, pp. 261-271.)

The authors present a very detailed account, illustrated by photographs and plans, of buildings and machinery erected by

this company for the preparation of the anthracite coal here produced. By way of introduction the mine conditions are briefly described. An average analysis of the coal shows: Moisture, 0.50; Volatile, 8.00; Fixed Carbon, 83.50; Ash, 8.00; In calorific value it is equal to 14,000 B.T.U. The coal is sized very nearly in accordance with Pennsylvanian practice. The cost of the breaker and incline is shown in an itemized statement, and represented a total of $119,175.58.

THE RESPONSIBILITY OF MINING ENGINEERS AND MINING DIRECTORS

By H. J. Carnegie Williams

(Vol. IX, pp. 281-284.)

Attention is directed to the clause in the Companies Act, 1900, of Great Britain, providing that any person wilfully making a false statement in any return, report, certificate, balance-sheet or other document, shall be guilty of a misdemeanour punishable by imprisonment. The hope is expressed that this provision will be incorporated in the Companies Act of Ontario. The author also refers to a decision reached by the Council of the Institution of Mining and Metallurgy respecting the definition of the term "Ore in Sight." He concludes that directors of mining companies are often not acquainted with the principles of mining, and those who are anxious to safeguard their own responsibility, as well as the interests of their shareholders, are obliged to rely upon the mining engineer, and "it therefore behooves everyone of us to carefully study and report only facts, and clearly state their reasons when it is a matter of deduction or assumption."

THE ATIKOKAN NICKELIFEROUS PYRRHOTITE DEPOSITS AND THEIR ORIGIN

BY F. HILLE

(VOL. IX, pp. 285-301.)

The author asserts that the Atik-Okan ore deposits are a counterpart of the nickeliferous pyrrhotite deposits of the Sudbury district.

ON THE NICKEL DEPOSITS OF WEBSTER, WESTERN NORTH CAROLINA

BY ALFRED E. BARLOW

(VOL. IX, pp. 303-316.)

The town of Webster is the capital of Jackson County, North Carolina. The area in the immediate vicinity is underlaid by the peculiar and characteristic basic magnesian rocks, containing the nickel deposits here described. The rocks belong to the peridotite family, represented mainly by the two rock species known as dunite and websterite, and certain altered derivatives. The nickel-bearing mineral is a hydrous silicate of magnesium and nickel, very closely allied in chemical composition to the noumeaite and garnierite of the New Caledonia nickel mines. Analyses are quoted to show that the Webster nickel mineral is closely related, if not identical with, other compounds found under practically the same conditions in other parts of the world. The ore, however, is, in general, of much lower grade than that, for example, of New Caledonia. These hydrous silicates of nickel and magnesium, constituting the Webster ore bodies, occur in the form of irregular secondary veins which traverse an intrusive mass of non-feldspathic basic magnesian rock of prevalent peridotite facies; and the veins are the direct product of the leaching of the peridotite by ordinary processes of subaerial decay.

NOTES ON DIAMOND DRILLING IN THE BOUNDARY DISTRICT

By Frederic Keffer

(Vol. IX, pp. 317-320.)

As an adjunct to prospecting and developing the low grade ore deposits of this district, the diamond drill has proved most effectual. As the ore bodies were developed it became apparent that the ore occurred in irregular masses, usually with no well defined walls; and again, the deposits are frequently separated by barren zones, so that when the boundary of an ore deposit is reached it is quite impossible to predict whether or not more ore will be found beyond. Hence the positive and negative value of the diamond drill, for the knowledge where ore is not to be found is only secondary to finding it. The author relates the methods of note keeping, recording daily progress and costs.

NOTES ON THE UTILIZATION OF POOR COALS AND SLACK

By D. B. Dowling

(Vol. IX, pp. 321-326.)

From the result of trials made under the auspices of the United States Geological Survey, it is deduced that the gas producer and the gas engine will in time replace the majority of steam plants, in which event the ability of a coal to produce gas will be the standard on which its value as a power producer will be based. The tests in question demonstrated that even the poorest of lignites yielded better results with the gas producer than was obtained with the best coal with a steam plant, and in every case the saving of fuel is enormous. The use of the poorest lignite is, therefore, the author states, suitable for the

production of power, and this should have special significance as regards the development of the lower grade coals and lignites of Western Canada. Respecting coal slack or breeze, it is remarked that the cement factories have demonstrated that a fine powder can be burnt in the furnace by blowing it in as a fine spray forming a long flame. The same method would appear applicable to other heating devices. Another possible use for fine coal is its manufacture as coke, and the admixture of different grades of coal in the fine state may, it is suggested, repay the expense of experimentation.

THE BRITISH COLUMBIA COPPER COMPANY'S MINE AND SMELTER

By FRANK G. WICKWARE, Student.

(VOL. IX, pp. 333-374.)

The author gives a very comprehensive account of the operation of the British Columbia Copper Company's Mother Lode mine, and of the smelter near Greenwood, in the Boundary district, B. C. This includes a history of the undertaking, a reference to the geology of the district, the character of the ore, and of the values therein, methods of mining, together with costs of the various operations, and conditions as regards labour.

THE NORTH SHAFT MINE OF THE SUSQUEHANNA COAL CO., AT NANTICOKE, PA.

By E. E. WINTER, Student.

(VOL. IX, pp. 375-386.)

In addition to a description of this colliery, and methods of working, the text is given of an agreement in force between operators in the region respecting barrier pillars and water drainage levels.

PROSPECTING DRILLS

By WALLACE DICKSON, Student.

(VOL. IX, pp. 387-395.)

The author discusses the capacities of drills of various types. In the Rossland district, drilling is done at the Le Roi mine on contract at the rate of $2.75 per foot; the cheapest drilling in the War Eagle mine was at a cost of $1.37 per foot. Over 2,600 feet were drilled in Ontario, under Government auspices, at a cost of $0.98 per foot. Costs elsewhere are mentioned. Instances of the use of the diamond drill for special work are afforded. Thus, in Butte, Montana, large holes of six inches are bored to carry water into old stopes to extinguish mine fires.

CYANIDE TESTS ON TEMISKAMING ORES

By JOHN J. ROBERTSON, Student.

(VOL. IX, pp. 396-401.)

From the result of laboratory tests the author believes that the ores of the Cobalt district may be profitably treated by cyaniding, after the removal of the concentrate; and that such a treatment will save a higher percentage of the values and be more suitable to the ore than amalgamation.

NUMBER FOUR PIT, BRAYTON DOMAIN COLLIERIES, CUMBERLAND, ENGLAND

By R. P. COWEN, Student.

(VOL. IX, pp. 402-412.)

A description of this colliery and of the methods of working are presented.

THE ORE DEPOSITS OF THE COBALT DISTRICT, ONT.

BY C. R. VAN HISE

(VOL. X, pp. 45-61.)

The mode of occurrence of the ore deposits of the Cobalt district illustrates, in a notable degree, the principles of two concentrations. The first concentration occurred under deep-seated conditions when the waters were free from oxygen, when arsenical, antimonial and sulphur compounds of cobalt, nickel and silver were deposited. Subsequently there was a second concentration through the influence of surface waters bearing oxygen and descending or travelling laterally. An adequate explanation of the ore deposits must combine the effects of the deep-seated and shallow circulations. The major portion of the cobalt-bearing minerals are products of an early concentration. After this main deposition, movements took place resulting in secondary fracturing of the veins, the openings permitting the entrance of silver-bearing solutions, whose contact with the cobalt minerals resulted in the precipitation of the silver. The author states: "Thus I incline to the view that the cobalt minerals appeared comparatively early, and that the later silver-bearing solutions appeared which resulted in the silver minerals. In presenting this view I do not mean to say that the deposition of the cobalt minerals had ceased before the silver began to be deposited, for the two may have overlapped to a considerable extent. The suggestion that the silver came in late and largely in connection with secondary fracturing explains many curious phenomena characteristic of the district." The source of the ore is stated to have been the diabase; the precipitating agents for the cobalt ores were probably in part from the conglomerate and Keewatin. Secondary enrichment has certainly been an important factor in producing the extremely rich superficial films of ores.

THE COBALT MINING DISTRICT

By Robert Bell

(Vol. X, pp. 62-68.)

The silver-bearing rocks have so far been found to consist of massive or crystalline diabase, but more especially of a volcanic breccia or agglomerate having a bluish and greyish matrix composed of hornblende porphyrite, while the contained fragments are mostly granite, with others of porphyrite and various forms of greenstones. In the Cobalt district, the brecciated rock extends beyond the silver-bearing area. The presence of the silver at Cobalt would appear, therefore, to depend on an original local impregnation of the parent breccia and diabase with the metal. The silver-bearing portion of the district is traversed by fissures or planes of disturbance along which, from time to time, the rocks were crushed by slight movements under great pressure, forming spaces in which mineralizing waters could rise from considerable depths. Development has demonstrated that the supply of ore does not depend on the small individual veins, but that there is some more general distribution of mineralization. This, the author believes, to be connected with the planes of fracture or disturbance which are more continuous and deeply seated than the individual veins on and near their course. Small cracks and branch veins from the main fissure may carry the silver to a considerable distance into the country rock. If this view is correct, a continuous production of the silver is to be expected by following these vertical zones of crushing and disturbance.

RICHNESS OF COBALT ORES

By Albert R. Ledoux

(Vol. X, pp. 72-73.)

The author presents a statement showing the silver values contained in 394 consignments of ore from the Cobalt district to New York. Of these lots the highest represented 7,402 ounces of silver to the ton; the next in order being 6,909, 6,413,

6,163 and 5,948 ounces per ton. The highest percentage of cobalt found in any one shipment is 11.96%. the average being 5.99%. The highest assay for nickel in any car is 12.49%, the average being 3.66%. The highest percentage of arsenic is 59.32%, the average 27.12%.

THE SMELTING OF COBALT ORES

By HIRAM W. HIXON

(VOL. X, pp. 74-76.)

The methods employed in smelting these ores should be based on: (1) The ores should be sorted and the metallic silver separated for direct smelting by cupellation with lead or melted in crucibles and poured into bars to be sold to refiners. (2) The ore should be ground in a dust-proof ball-mill to such a fineness that it can be accurately sampled. (3) The ground ore should be roasted in a suitable furnace to expel the arsenic and sulphur. (4) The gases from this roaster should pass through a long sheet-iron dust-chamber to cool it and then be passed through a bag-house where all the dust and volatilized arsenic will be recovered. (5) The roasted ore should then be briquetted with a strong bond of red clay and lime water and dried or frozen, after which it should be smelted in a blast furnace with about an equal weight of galena or lead concentrate containing about 50 to 60% lead. The necessary iron and lime would be added to the charge to produce a slag of proper composition.

THE NEW TILBURY AND ROMNEY OIL FIELDS, OF KENT COUNTY, ONTARIO

By EUGENE COSTE

(VOL. X, pp. 77-84.)

Oil was first struck in the Tilbury field in December, 1905. At a depth of 1,360 feet gas was encountered; again at 1,375 feet; then the first oil pay with more gas at 1,385 feet; then a

second oil pay at 1,410 feet and a third at 1,430 feet. The well, after the shot, started to flow at the rate of forty barrels of oil per day, and gas at the rate of about half a million cubic feet per day. To date 150 wells have been drilled, proving the extent of the oil territory over an area of two miles east and west by five miles north and south. The limits of the field to the north and south are still unknown. Large gas wells have also been opened in the field, from one the supply measuring seven million cubic feet of dry gas a day. This was tubed, packed and closed in, the regular rock pressure of the enclosed gas being 650 lbs. to the square inch. Later the gas was piped to the city of Chatham, ten miles distant. An analysis of this gas indicates that it compares favourably with the natural gas of Ohio and Indiana. The oil from the Tilbury field is of 38 to 41 degrees Baume gravity, and belongs to the same class as the Lima, Ohio, the Indiana, and the Petrolia and Oil Springs (Ontario) oils. The oil is bought from the producers by the Imperial Oil Company at the rate of $1.14 per barrel. In addition the producer receives $52\frac{1}{2}$ cents per barrel in the form of Government bounty. The author points out that an import duty for the protection of the Canadian oil producer is in every respect preferable to the bounty system. The paper also contains a description of the geology of the Tilbury oil field.

CANADIAN GRAPHITE

By H. P. H. BRUMELL

(VOL. X, pp. 85-104.)

The Canadian industry dates from about 1860, although it has not "until very recently been successful in this country." The only deposits of value are confined to rocks of pre-Cambrian age, the mineral being found usually in the Grenville series, or upper beds of the Laurentian system. Certain less important deposits of amorphous ore are occasionally met with in rocks of Devonian or lower Carboniferous age. The author traces

the history of graphite mining in Canada, describes the character of the product and notes prevailing market conditions and also the uses to which the mineral is put, emphasizing in particular its value as a lubricant. The statistics of graphite production in Canada and elsewhere are appended.

NEW DISCOVERIES IN NORTHERN QUEBEC

By J. OBALSKI

(VOL. X, pp. 105-107.)

Attention is directed to the results of prospecting and development operations in the Chibougamau district, the valley of the Bell River and in the north of Pontiac county, in Quebec; and the more important discoveries and the geological features in connection therewith are summarized.

IRON MINING POSSIBILITIES IN THE PROVINCE OF QUEBEC

By FRITZ CIRKEL

(VOL. X, pp. 108-117.)

There are large deposits of iron ore in the province of Quebec. These notably include deposits of magnetic sands distributed along the banks of the St. Lawrence, Ottawa and Gatineau rivers. On the St. Lawrence, the deposits at Moisie, Mingan, Betsiamits, Natashquan and Kagashka are specially important. The sand is found, almost on the surface, in stratified beds from one half an inch to two feet thick with a very considerable horizontal distribution. In quality they are compared favourably with Swedish ores, analyses indicating a metallic iron content ranging from 55.23 to 66.73%, with no sulphur or phosphorus, although titanic acid, from 3.40 to 16.00%, is present. In addition important

deposits of magnetic iron occur in the township of Pontiac, and in Hull, north of Ottawa. It is pointed out that the ores here are rich, the bodies large, and the conditions such to provide for economical working. The author then states that for the "concentration of these iron ores, which are to a great extent of low grade," the methods adopted at the mines near Port Henry in the Adirondacks, where conditions are similar, are suitable. The practice in question is described.

THE ORIGIN OF DEPOSITS OF PYRITES

By A. B. WILLMOTT

(VOL. X, pp. 118-128.)

The four more important theories respecting the origin of pyrites are: (1) Impregnated beds; (2) Veins; (3) Sedimentary beds; (4) Magmatic segregations. The first assumes that iron and sulphur as a soluble salt has found its way into porous beds, and been there precipitated as the sulphide. The country rock has in most cases been more or less replaced. Fracturing of the rock has promoted circulation. The mode of formation is similar in most respects to the second or vein deposits, and there are cases where the two methods are indistinguishable. The third theory assumes the precipitation of iron sulphide from solution as a bed at the bottom of shallow water. Other chemical and mechanical sediments occur above and below such beds. This theory in common with the first and second, presupposes the iron and sulphur in the form of a soluble salt, and precipitation brought about through a change in conditions. The fourth theory supposes that the iron sulphide has separated out of a cooling igneous mass. Several physical principles are suggested to account for the segregation, and citations and quotations are presented to illustrate current opinions. The author then describes in detail Ontario occurrences, including that near the Helen iron mine, Michipicoten, at Strawhat Lake, Schreiber and those of others in Hastings and Lanark counties. It is concluded that for a number of the Ontario pyrite bodies, the origin has been one of chemical sedimentation.

THE ELECTROTHERMIC PRODUCTION OF STEEL FROM IRON ORE

BY ALFRED STANSFIELD

(VOL. X, pp. 129-133.)

Stassano has made numerous experiments on the direct production of steel from iron ores, but he used pure Italian ores only, nearly free from sulphur, and the Government experiments at Sault Ste. Marie were solely directed to the production of pig iron. The experiments conducted by Mr. J. W. Evans, however, (an account of which is published in the Journal of the Institute, Vol. IX, p. 128 et seq.) show that an iron ore with 1% of sulphur mixed with suitable proportions of charcoal and lime and heated electrically in a crucible will yield a steel low in carbon and silicon and containing from .08% to .17% of sulphur. Two of the author's students attempted to repeat the experiments, aiming in particular to solve whether, in smelting iron ores for the production of steel, phosphorus and sulphur would be eliminated. The conditions under which these experiments were conducted are described and steel and slag analyses are presented indicating that the carbon in the steel can be lowered to about 0.09%, but that any further reduction in the amount of carbon charged merely increases the already large percentage of iron oxide in the slag, without lowering the carbon in the steel to a further degree. The lowest sulphur obtained was .34%. The experiments further indicated that in the electrothermic production of steel directly from a sulphurous ore, it is not easy to remove the sulphur, in an electric furnace operated continuously, although it may be possible with intermittent operation. Phosphorus, on the other hand, can be satisfactorily removed when low carbon steel is produced.

THE SUPPLIES AND RESERVES OF IRON ORES

BY JOHN BIRKINBINE

(VOL. X, pp. 134-148.)

The author discusses the iron supplies and reserves of the world. He takes exception to the estimate made by Professor

Tornebohm, of Sweden, who computes the total reserves of the world to be 10,000,000,000 tons, considering that the resources of the United States have been under-estimated, while no specific account is taken of Canadian resources. He states, the prophecies of exhaustion of iron ore depend for their fulfillment on a practical continuance of existing conditions. If the study of the iron ore reserves is undertaken in connection with present or possible fuel supplies, with consideration of prospective producing and consuming centres, the time when iron may be a "precious metal" or the available supply of iron ore becomes exhausted may be so far in the future as to allay any present anxiety. The greatly augmented production of iron ore is undoubtedly making heavy draughts upon the iron mines now being worked; but when the probabilities of known, but not developed deposits, are considered, when the possibilities of advanced metallurgy are studied, and when we realize how much of the earth's surface and geology is still unknown, or imperfectly known, "one need not be an optimist to express confidence that an ample supply of ore will be found to meet the needs of mankind."

THE BRUCE MINES, ONTARIO, 1846-1906

By H. J. CARNEGIE WILLIAMS

(VOL. X, pp. 149-161.)

The property was first "staked" by a Mr. Keating in 1846. It was purchased by the Montreal Mining Company for £40,000, in the same year; and in 1848 machinery was installed. A first attempt to smelt the ore locally was unsuccessful. In 1854, Mr. Sampson Vivian, having acquired a lease of the western portion of the property on a royalty basis, succeeded in forming a company in England, under the auspices of John Taylor & Sons. Soon thereafter an important new discovery of ore was made, and, in 1864, Messrs. John Taylor & Sons purchased the entire property from the Montreal Mining Company. It would appear that the Bruce area produced, up to 1857, 583.22 tons of fine copper. The mines were worked by the new owners, the West

Canada Mining Company until 1876, when operations were suspended until 1898. In that year the property was secured by some English capitalists. In 1905 the author was commissioned to examine the mine, and his report being satisfactory, a company was registered in Ontario and work resumed. The copper ores, chiefly chalcopyritic, found in abundance, are distributed in well defined bodies or zones. There are three classes of ore occurrence: (1) In the quartzite, specular iron is often associated with the chalcopyritic, and in places chalcocite is found on the surface; (2) In fissure veins of the upper conglomerate, in which the copper occurs as melaconite, cuprite, native, chalcocite, chalcopyrite, with apparently a little pyrrhotite; (3) Lodes formed in the diabase. The average copper content is said to be $3\frac{1}{2}$ per cent. The known extent of the lodes is 8,000 feet longitudinally. The author briefly outlines the concentration practice here.

THE GEOLOGY AND ORE DEPOSITS OF FRANKLIN CAMP, B. C.

By R. W. Brock

(Vol. X, pp. 170-179.)

Franklin Camp is situated on the east branch of the north fork of the Kettle River, forty-three miles distant from Grand Forks, in the Grand Forks Mining Division of Yale District. The geology of the camp is somewhat complicated. The oldest recognized rocks are sedimentary, often greatly metamorphosed, limestone predominating. Some argillites occur in this series, and closely associated are some greenstones. Large masses of grey Nelson granodiorite is intrusive in these basal rocks; and both formations are intruded by small masses of a gabbro-like rock and by a porphyritic syenite. At many points, Tertiary rocks, consisting of quartzite-like gritty tuffs with coarse conglomerate bands, conglomerates and ash-beds overlie these formations, while the Tertiary rocks are in turn overlain by lava flows with some inter-leaved ash rocks.

The discovered deposits are more or less distinctive in type. Thus: (1) Those in which the gangue consists of country rock altered to green lime-silicates with quartz and calcite. Such deposits are, for convenience, styled those of the limestone type. They differ in the relative amounts of their metallic minerals, and so are sub-classified as (a) Pyritic—pyrite and chalcopyrite predominating; (b) Magnetitic—magnetite with some copper and iron sulphides predominating; (c) The metallic minerals consist of galena, blende and chalcopyrite. (2) Chalcopyrite or pyrite deposits with molybdenite, calcite and quartz in crushed zones, fractures, fissures or near contacts. Replacements or substitution of the minerals of the country rock by ore is usually conspicuous. For convenience this class of deposit is termed the granite type. (3) Quartz veins, in which the quartz is the dominant mineral, accompanied by galena, blende, pyrite, chalcopyrite, molybdenite, arsenopyrite, etc. The author describes these occurrences in detail. In its geology and the nature of its ore deposits, Franklin camp, he states, bears a strong resemblance to the Boundary District. While nothing can yet be said of the extent and value of the mineralization, the indications are in the main promising.

REVIEW OF PROGRESS IN THE MINERAL PRODUCTION OF BRITISH COLUMBIA

By E. Jacobs

(Vol. X, pp. 183-187.)

According to the official records, British Columbia's total mineral production to the close of 1906 represented a value of $273,643,000, derived as follows: Placer gold, $68,721,000; Lode gold, $41,016,000; Silver, $25,586,000; Lead, $17,626,000; Copper, $35,546,000; Iron and Zinc, $270,000; Coal, $72,815,000; Coke, $6,520,000 and Building Materials, $5,543,000. The author reviews the progress and development of the respective industries.

THE EMMA MINE

BY FREDERIC KEFFER

(VOL. X, pp. 188-194.)

Among the low grade mines of the Boundary District, B. C., the Emma is in a sense unique, in that the magnetite, which constitutes the main portion of the ore body, has persisted from the surface to a depth of at least 250 feet in a practically continuous vein or deposit; and also in that the vein stands vertically so far as explored. In the other low grade mines of the district magnetite is a frequent constituent of the ores, but its occurrence is most erratic, the deposits being irregular, and frequently dipping entirely at variance with the general dip of the ores with which they are associated. The occurrence at the Emma is described in detail, the author also describing the method of mining the deposit, which on account of its vertical position, is relatively simple.

FURTHER OBSERVATIONS RELATIVE TO THE OCCURRENCE OF DEPOSITS OF COPPER ORE ON THE NORTH PACIFIC COAST AND ADJACENT ISLANDS, FROM THE SOUTHERN BOUNDARY OF BRITISH COLUMBIA TO THE ALASKA PENINSULA

BY WM. M. BREWER

(VOL. X, pp. 195-208.)

Since submitting the paper published by the Institute in Vol. IX, (pp. 39-48) the author has made further investigations, which have confirmed the view that the classification of the various deposits of copper ore as then noted, is substantially correct. He presents additional data respecting the occurrences of copper ore at Texada Island, B. C., Whitehorse, Y. T., and other localities, and reviews the result of development operations

at the more important Pacific Coast copper mines. Attention is also directed to the copper deposits near Portland Canal and to those in the Prince William Sound District of Alaska. It is observed in conclusion, that there are certain characteristics common to all the occurrences of copper-bearing ores on the Pacific coast. Thus, garnet and epidote are almost invariably found in association with the copper ore and the presence of these minerals in the gangue is a sure indication of copper. Another characteristic is that appertaining to the lenticular structure of the deposits and the absence of what may be termed "true leads."

RECENT DEVELOPMENTS IN MINING IN THE SOUTHERN YUKON

BY D. D. CAIRNES

(VOL. X, pp. 209-217.)

Reference is more particularly made to mining developments in the Conrad Mining District, embracing the Windy Arm and the Watson and Wheaton rivers' areas. Topographically the country is rugged and mountainous, and since most of the mineral claims are situated high up on the bleak mountain sides, the expense and difficulties of preliminary working were great. The district, itself, however, is readily accessible. The minerals, the values being principally gold and silver, are found in true fissure veins of quartz, to a minor degree in granite, but in the majority of instances in a formation consisting of a somewhat complex series of porphyrites, diorites, gabbros, etc, apparently originating from the same magma, but differentiated under varying conditions of cooling and segregation. The veins are noticeably persistent in length, but vary from a few inches to as much as 30 feet in width. The principal value-containing mineral is argentiferous galena, but some native silver, argentite, stephanite, pyrargyrite, tetrahedrite, chalcopyrite, jamesonite, stibnite, lead carbonate, etc., are also found. Some of the

more important claims in the district are described in detail, the discovery of gold-telluride minerals on a property in the Wheaton section being specially noted. This ore yielded values of from $20.00 to $60.00 per ton, while some specimens assayed $300.00 and over. Brief reference is made to copper mining at Whitehorse and to the discovery of coal at Tantalus, some 190 miles distant, on the Yukon river. Analyses of this coal showed volatile matter from 23.61 to 25.12; fixed carbon from 55.21 to 66.03; and ash, from 8.03 to 20.43. It is said to yield in the laboratory a firm coherent coke, and should, consequently, be of value in the event of the establishment of a smelting industry at Whitehorse.

SOME NOTES ON THE ECONOMIC GEOLOGY OF THE SKEENA RIVER

By W. W. Leach

(Vol. X, pp. 218-228.)

The formations are classified under four main divisions, to which in their southern continuation in the neighbourhood of Francois Lake, Dr. G. M. Dawson applied a nomenclature as follows: 1st, the Cascade Crystalline Series; 2nd, the Cache Creek Group; 3rd, the Porphyrite Group; and, 4th, Rocks of Tertiary age. The rocks of the third division, covering by far the most extensive area, are of main economic interest, since all recent discoveries of mineral have been made in this formation. In, and adjacent to the Bulkley valley these rocks cover a wide area and have been studied in more detail than elsewhere. Here the volcanics have been cut in various places by intrusive granites, the mineralization being chiefly in evidence along the contacts. In the vicinity of Bulkley there appear to be three main mineral-bearing belts, the most important being near the head of the Telkwa river. Another is situated at the head of the Zymoetze or Copper river, including Hudson Bay Mountain; and the third is on the Babine Range, between Bulkley and Babine Lake. On the Telkwa river, the ores are

prevailingly copper, while galena is found in the other districts mentioned. The occurrence of coal has been reported from many widely separated localities in the Skeena watershed. Some of these coals are of no economic value, but others on the lower Telkwa are of good steaming quality, and a third class is described as semi-anthracite. None of the coals, however, makes coke. The author remarks that the inaccessibility of the region has heretofore prevented the exploitation of its resources; but that it is undoubtedly a region rich in possibilities.

THE COALS AND COALFIELDS OF ALBERTA, SASKATCHEWAN AND MANITOBA

By D. B. Dowling

(Vol. X, pp. 229-237.)

The rocks in which these coals are found, belong to the sediments of the Cretaceous sea, the coal horizons representing three successive intervals of this period. The first is termed the Kootanie; the second or middle, the Belly River; and, the third, or top, the Edmonton or Laramie. The quality of the coal in the three formations varies, the conditions being determinable by two tolerably well established rules: (1) In the same district coals of the lower horizon in consequence of age and of pressure from the beds above, should possess a larger percentage of fixed carbon and will be also more compact; (2) There is a general tendency of both the fuel ratio and compactness to increase as the mountains are approached. This is attributable mainly to the increasing thickness of all the deposits in this direction. The author enumerates the coal seams in the respective horizons, giving also in tabulated form the fuel ratios of the coals. The fuel ratio, it is explained, is the fixed carbon divided by the volatile combustible matter.

THE MARBLE BAY COPPER DEPOSIT

BY O. E. LE ROY

(VOL. X, pp. 242-250.)

The Marble Bay mine, on Texada Island, B. C., is of particular interest, both on account of the deposit being in a contact metamorphic zone and of its economic importance. Texada Island is underlain by the Vancouver series of Dawson, part of which has been referred to the Triassic. The series admits of two divisions; the lower, composed of chlorite and hornblende schists, tuffs, amygdaloidal lavas, porphyrites and agglomerates; and, the upper, consisting of limestone. Subsequent to the deposition of the limestone there was considerable volcanic activity, and the whole of the Vancouver series was much disturbed by intrusions of diorite, gabbro, hornblende and augite porphyrites and diabases. In upper Jurassic times extensions of the great Coast Range batholith, consisting of granites and syenites, penetrated the older series, producing schistose structure and shear zones in many of the igneous rocks. This was followed by a series of basic dykes. After referring briefly to the occurrence of gold in quartz veins, and of magnetite on the island, the author describes in detail the deposit of bornite and chalcopyrite at the Marble Bay mine. The deposit occurs in the limestone, and is closely connected with the intrusion of the coast granite, being clearly of pneumatolytic origin. The ore is essentially high grade, carrying values in gold and silver. The percentage of copper has steadily increased with depth. The ore is hand sorted and graded into coarse and fines. The average nett value of the former, as shown by smelter returns is $28.77; and of the latter, $6.88. As regards the permanence of the deposits, the author states that there seems to be very little doubt but that they will continue until the limestone-granite contact is reached.

SOME NEW POINTS IN THE GEOLOGY OF COPPER ORES

BY JAMES F. KEMP

(VOL. X, pp. 251-256.)

Twenty-five years ago the students of mineralogy were taught that chalcopyrite was the principal ore of copper. To-day chalcocite furnishes much the greater proportion of the copper produced. Thus, chalcopyrite instead of being the principal mineral in Butte, is rather uncommon. Alike in Butte and in Arizona the original mineral appears to be a lean copper-bearing iron-pyrite, which is then by secondary enrichment, oxidized in one place and deprived of its copper, only to gain the latter elsewhere in the form of chalcocite. The origin of chalcocite is considered. Experience thus far is conducive to the belief that it is a secondary mineral. Most reasonable of all would appear to be W. H. Weed's suggestion of secondary enrichment by uprising solutions of copper. From these no lean pyrite of primary deposition so far observed would be too deep to escape. Ten years ago, or even less, great apprehension was felt concerning the persistence of ore in depth. The newly appreciated doctrines of secondary enrichment from above had emphasized and increased the misgivings; but if, as at Butte, 40% ore occurs in great stopes at 1,800 feet, and 60% ore at 2,400 feet, it is questionable whether the earlier generalization is as sweeping as formerly appeared. The fallacies of the opinions whereby ore bodies, especially of copper, were connected with basic eruptives, and that as iron and the other bases increased in rocks, therefore copper, lead, and other metals would do the same in less degree, are demonstrated, and the author furthermore remarks on the tendency of mines first worked for other metals to yield copper in depth. He states: "We have for years known that lead above often passed into zinc below. We may, perhaps, now add a still deeper copper zone, when, in the uprising waters that brought in the ore, copper was present with the other two. Gold above may also change to copper below, or be associated with it, and apparently not always because copper once general throughout the vein has passed downward with the atmospheric waters."

THE GENESIS OF THE COPPER DEPOSITS OF YERINGTON, NEV.

BY E. P. JENNINGS

(VOL. X, pp. 257-260.)

The Yerington copper deposits are in Lyon County, Nevada, 40 miles southeast of the famous Comstock Lode. The copper ore occurs in a garnet rock as an impregnation throughout portions of its mass and as richer concentrations in fractures and shear zones; also as bedded veins in a crystalline limestone. The mine developments are not sufficiently advanced to connect the limestone ore bodies with those contained in the garnet, "but it is difficult to avoid the conclusion that in depth the two classes of ore bodies will connect, forming a continuous lode whose lower boundary is the granite and with its apex the limestone. If this view is confirmed by later work, the deposits will be of great interest as illustrating the genesis of ore bodies due to the action of intrusive rock masses, the magmatic waters of which have mineralized certain pre-existing fissures, and, together with the heat derived from the molten magma, has converted certain sedimentary beds into garnet rock containing more or less disseminated ore and other beds in a higher horizon, into marble, and also filling fractures parallel to the bedding of this marbleized limestone with copper ore."

MAGNETIC CONCENTRATION OF IRON ORES BY THE GRONDAL PROCESS

BY P. MCN. BENNIE

(VOL. X, pp. 261-273.)

After describing the Grondal process of magnetic concentration, the author shows how it might be applied to advantage in the treatment of Canadian iron ores. There are, for example, many bodies of magnetic iron ore in Ontario, averaging from 35 to 50 per cent. iron, which with proper treatment could be made highly valuable. For ores requiring fine grinding, the Grondal

briquette affords a means of converting an unsalable into an article that will actually command a premium. Such briquettes are now being consigned in large quantities from Sweden to Great Britain, where they find a ready market at an advanced price. The application of electro-thermic processes to the production of high-grade pig iron and steel, is also certain to be of economic importance to Canada. The fortunate existence, practically side by side, of iron mines and extensive water powers in this country, provide exceptional advantages in this regard.

THE MICROSTRUCTURE OF NICKELIFEROUS PYRRHOTITES

By William Campbell and Cyril W. Knight

(Vol. X, pp. 274-280.)

Typical specimens were obtained and examined from the Sudbury deposits, from St. Stephens, N. B., from Sohland, Germany, from Norway and elsewhere. In all were found certain points of similarity and a regular order of succession. The magnetite is an original constituent, being older than the silicates, which are usually more or less broken and contain veins and masses of the sulphides. These latter occur in a definite order: (a) pyrrhotite; (b) pentlandite; (c) chalcopyrite. The pyrrhotite generally shows evidences of strain and fracture before the advent of the pentlandite, which was closely followed by the chalcopyrite, the two having a habit in common. It is concluded that the mode of origin of the respective occurrences was identical. Long after solidification, the basic rocks were more or less cracked and broken, and then solutions deposited pyrrhotite by replacement, etc. Later on the pyrrhotite in turn became strained and broken and then pentlandite was deposited. The pentlandite was closely followed by chalcopyrite.

THE USE OF GRAPHIC FORMULAE IN METALLURGICAL CALCULATIONS

BY D. H. BROWNE

(VOL. X, pp. 281-300.)

The daily records of furnace practice, the charge sheets, analyses, blast records, etc., are of value only in so far as they leave a permanent record in the minds of the furnace superintendent and his foremen, which record is termed "experience." As all these data, daily accumulating, become in time too numerous for the mind to carry, it is necessary to reduce them to terms of some common denominator and to group them in ways that will make them understood. In furnace practice also, certain calculations are daily necessary, and these may be reduced to simple tables or charts. The author, therefore, outlines the methods whereby the records of one particular ore may be tabulated and reduced to graphic formulae. If, he remarks, a standard method, applicable to all ores, could be devised, then the science of metallurgy would approach the status of an exact science.

MAGMATIC WATERS

BY HIRAM W. HIXON

(VOL. X, pp. 301-320.)

The author assumes that the earth was once molten, even gaseous, and that the interior is still so. This strengthens, it is maintained, the evidence of the presence of water in the interior magma. He states that if all of the magmatic waters discharged annually could be determined, and divided into the waters contained in all the oceans, lakes and rivers, it would be possible to arrive at the approximate age of the earth since water began to condense on its surface. He remarks that the value of magmatic waters to man may be estimated if it be considered that all the metal veins, with the exception of the oxidized ores of iron, are collected directly and solely by the deposition of sulphides from ascending hot solutions.

THE STATUS OF THE MINING PROFESSION

By J. C. Gwillim

(Vol. X, pp. 321-327.)

The author deprecates the methods of unscrupulous mining promoters who publish false or misleading statements in order to ensnare the public, the effect of which is, he declares, ruinous to legitimate mining. He refers to the steps taken in California for the prevention of fraudulent attempts of this nature, and asserts that while mining is usually regarded as a "gamble," if "roguery, misrepresentation, and lack of skill were eliminated to the same degree as they are in the operation of railroads, manufactures, and other industrial undertakings, we might deal successfully with the element of chance, and reduce speculation to investment." He advocates that mining engineers take steps to protect themselves and the public by having a registered membership; and urges the Institute as a body to undertake measures to prevent "the publication of prospectuses of an irresponsible character, the statements in which are not vouched for by some person of recognized standing."

ROYALTIES ON MINERALS IN ONTARIO

By J. M. Clark

(Vol. X, pp. 340-341.)

Referring to a proposal to impose royalties on minerals in Ontario the author notes that many explorers and prospectors have spent all their resources and a large part of their lives in searching for mineral deposits in Northern Ontario. If a blow at the mining industry is now struck by the Legislature the fruits of their labours will be unjustly snatched from them.

SIR WILLIAM E. LOGAN AND THE GEOLOGICAL SURVEY OF CANADA

By Robert Bell

(Vol. X, pp. 342-370.)

The author gives some personal reminiscences of Sir William Logan, and recounts several entertaining anecdotes illustrative of the character and disposition of this eminent geologist.

BASIC OPEN-HEARTH STEEL MANUFACTURE, AS CARRIED OUT BY THE DOMINION IRON AND STEEL COMPANY. AT SYDNEY, C. B.

By Frank E. Lathe, Student.

(Vol. X, pp. 373-396.)

The ore is a silicious hematite of medium grade obtained from the company's mines at Wabana, Newfoundland. From this a pig is produced, which cannot be treated in an acid furnace, nor is it suited to basic Bessemer practice. It is, however, most amenable to open-hearth treatment. The author describes fully modern practice in this direction, and refers specifically to the plant and methods at the Dominion Iron and Steel Company's works at Sydney.

UNDERGROUND MINING METHODS AT THE QUINCY COPPER MINES, MICHIGAN

By G. R. McLaren, Student.

(Vol. X, pp. 399-417.)

The author presents a general description of this mine and includes therewith a note on the geology of the neighbourhood and on the origin of the copper deposits. The Quincy, he states,

holds the record for the cheapest production of copper in the district, namely that of 5.7 cents per lb. of refined metal. This was accomplished in 1894. The present cost of production is at the rate of about 9 cents per lb. Costs at other mines seem to range from rather over 7 cents to 11 cents.

THE CARIBOO CONSOLIDATED HYDRAULIC PLANT BULLION, B. C.

By W. J. Dick, Student

(Vol. X, pp. 418-425.)

The property is situated at Bullion, in the Quesnelle Mining Division of the Cariboo District, B. C., and comprises thirty-four placer mining leases, aggregating two thousand, five hundred and fifty four acres. The leases cover, for a distance of ten miles, the auriferous deposits of a system of ancient rivers. The author describes the method of working and equipment. A statement of operating expenses for the season of 1904 is also included. To 1905 the total amount of gravel washed was 12,535,009 cubic yards and it is estimated that the gold recovered between 1894 and 1904 inclusive represented a value of $2,108,734, or an average yield of 16.8 cents per cubic yard.

THE OLDHAM STERLING GOLD MINE, NOVA SCOTIA

By C. V. Brennan, Student

(Vol. X, pp. 426-437.)

The Oldham Sterling gold mine, in the Oldham district, Halifax County, Nova Scotia, is situated about $3\frac{1}{2}$ miles east of Enfield, a small station on the Intercolonial Railway. The district is one of the richest in the Province, gold having been

first discovered here in 1861. The author refers briefly to the history of the Oldham mine, the geological conditions in the locality and the mode of occurrence of the gold in the quartz veins. This is followed by a description of mining and milling methods.

THE USES OF CHEMICAL ANALYSIS IN IRON BLAST FURNACE PRACTICE AND SOME NOTES ON LABORATORY METHODS

BY GEORGE D. DRUMMOND, Student

(VOL. X, pp. 442-462.)

The author describes the Midland Furnace of the Canada Iron Furnace Company, at Midland Bay, Ontario, and discusses the methods employed in the analytical determination of raw materials and furnace products.

General Index

Vols. I. to X.

GENERAL INDEX

A

	Vol.	Page
Aberdeen, Lord	I	17
Aberdeen Tp., ALGOMA, ONT.		
Iron ore in	VII	258
Abitibi River, near JAMES BAY, ONT.		
Gypsum on	VII	166
ABRAHAMS, L. J.		
**Occurrence of Diamonds in South Africa, with the method of their extraction as adopted at the De Beers Diamond Mines*	V	62-75
Abrasives		
BAKER, notes on	VII	410, 420
Carbide of titanium	III	197
CARTER, notes on	VII	160
Corundum	III	199, 201 203
Abruker Mica Mine, India	VII	297
Acadia Coal Co.		
Production (1900)	IV	310
(1901)	V	583
Accidents (COAL MINING) :		
see also Explosions, Colliery Explosions, etc.		
Fatalities; Gt. Britain, United States and Nova Scotia, comparative table of	VI	452, 488
in Nova Scotia (1902)	VI	447–8
Regulations in North West Territories, re	V	3
Safety Lamps as cause of	V	379 et seq
Royal Commission report on	VI	212
Accounting: *see under* Mines and Mining, Cost Accounting, Costs, etc.		
Acetylene Gas:		
Brayton Domain Colliery, Eng., plant at	IX	404
Cost, lighting	II	232
Danger of, when liquid	II	229, 230
not Explosive when pure	II	229
as Illuminant in Grand Calumet mine	II	228
Lewis' experiments	II	230
on Locomotives	II	228

* See Summaries, page 40.

	Vol.	Page
Acetylene Gas—Con.		
Manufacture	III	136
Mine illuminant	IX	404
Discussion on: (HOLLAND, HARDMAN, COSTE, ANDREWS)	II	227–232
Ontario, first used in	III	136
Production, note by COSTE	VI	75
Qualities	II	228
Acheson, E. G.		
Artificial graphite, manufacturing methods of	X	103
***ACID MAKING FROM PYRRHOTITE.** SJOSTEDT	VII	480–494
Acme Oil Company, DETROIT, U.S.A.		
Operation of, in Ontario	X	77
†***ACROSS THE PITCH VERSUS UP THE PITCH.***		
WHITESIDE	II	17–20
	IV	126–130
Actinolite:		
Asbestos	V	346
Boundary Dist., B.C.	V	369
Hastings Co., Ont	VII	167
Ontario industry, notes by MILLER	V	247
production (1902)	VI	464
(1903)	VII	430
Uses	V	251
Actinolite (Bridgewater) ELZEVIR TP., HASTINGS CO., ONT.		
Actinolite mining and milling at	V	247
	VII	167
Arsenopyrite	IV	208, 210 223
Asbestos mining, near	VII	167
Mispickel at	V	241
Acton Copper Mine, ACTON, QUE.	III	188
	V	81
	VII	398
Acton (Rocky Mountain) House, NORTH SASKATCHEWAN RIVER, ALTA.		
Coal at	X	236
Adams, Cyrus C.	X	138
ADAMS, Dr. Frank D.		
Discussions by, on:		
Are there diamonds in Ontario	III	195
Artesian and other deep wells on the island of Montreal	VIII	97–100
Geological Survey of Canada as an educational institution	VII	438
Gold measures of Nova Scotia and deep mining	II	248
National importance of mining	V	585–589
Occurrences, production and uses of mica	VII	306
Ontario corundum deposits	III	201–202
Ore deposits and geology of the Sudbury district	IX	234–235
Relative attraction for some common minerals for residuum oil	VII	191
Undeveloped mineral resources of Ontario	VII	395
Volcanic origin of natural gas and petroleum	VI	474

* See Summaries, page 90.
† " " 3 & 28.

ADAMS, Dr. Frank D.—Con.

Papers by, on the	Vol.	Page
**Artesian and other deep wells on the Island of Montreal*	VIII	76–97
†*Need of a Topographical Survey of the Dominion of Canada, particularly with reference to the Development of the Economic Resources of the Dominion*	IX	74–86
‡*Notes on the Iron Ore Deposits of Bilbao, Northern Spain*	IV	196–204
Elected Councillor (1904)	VII	22
(1907)	X	17
Vice-President C.M.I. (1902)	V	603
(1905)	VIII	34
(1906)	IX	26
Recommended for Directorship of Geological Survey	IV	74
Views on:		
Civil Engineers Bill	V	561
Derivation of Serpentine	VIII	267
Gneisses of Grenville Series	IX	311
Work of Dawson	IX	100
Minor References	VII	444, 448
	IX	6, 22
	X	5

Adams, Geo. I.
Views origin of Petroleum ... VI 94

Adams, R. C.
Views on a Canadian Dept. of Mines ... V 595
Death ... VI (x)

Addington County, ONT.:
Galena Ores ... VII 143
Graphite mining ... VII 161
Molybdenite deposits in ... VII 164

Adirondack Mts.
Iron ores in ... X 111

||*ADJUSTMENT AND CONTROL OF THE STAMP MILL.* DEKALB ... II 149
Discussion on, by De Kalb, Hardman, Snyder, Stuart II 205, 206

¶*ADVANTAGES OF COMBINING TOPOGRAPHICAL WITH GEOLOGICAL SURVEYING IN UNEXPLORED REGIONS.* R. BELL ... VIII 56, 58

°*ON THE ADVISABILITY OF THE ESTABLISHMENT OF A FEDERAL DEPARTMENT OF MINES,* LAMB . IX 87–106

Aerial Tramways, *see also* Tramways
Le Roi Mine, Rossland, B.C. ... V 332
Operating Costs ... V 336, 337
Port Morien, C. B. ... IV 131 et seq
St. Eugene Mine, Moyie, B. C. ... V 512

---

* See Summaries, page 95
† " " 113
‡ " " 32
|| See Summaries, page 12
¶ " " 93
° " " 113

	Vol.	Page
Africa:		
Coal Production (1801-1900)	VI	25
(1898-1900)	VI	31
Hart River		
Diamantiferous formation	VI	79
Jagersfontein, Orange River Colony		
Diamond mines	V	62
Johannesburg		
Saddle Reefs	IV	48
Kimberley, Cape Colony		
Diamonds, discovered at	VI	35
mines	III	155
	V	62 et seq
Ag, Sweden, *see under* Sweden		
Agassiz, Prof.		
Quoted on topographical surveys	IX	90
Agate:		
Franklin Camp, B. C.	X	172
Agglomerate:		
Rossland Dist., B.C.	V	520
Agitation:		
Silver ores, Slocan Dist., B.C.	VII	202
Agriculture:		
British Columbia Statistics (1901)	VI	357, 363
(1906)	X	187
Ainsworth Mining Div., B. C.	V	11
Concentration in	VI	152
Lead ores	VI	148
Ore deposits, notes by Corless	V	508
Statistics (1892-1901)	VI	150
Zinc mining in	VII	369
Air:		
Calculating weight of	II	131
Moisture in	V	159
Pumps, description of	V	162
	VII	528
Paper, *see page* 66 Smmmaries.		
Refrigerating	II	141, 142
Air Compressing:		
Costs	V	327
Belmont gold mine. Paper by KERR	VI	233–244
Effective horse-power, determination of	II	130
Frost, effect of	VI	244
Le Roi mine, Rossland, B.C.	V	327
THOMPSON, paper on, by	VI	180–7
AIR COMPRESSION BY WATER POWER. THE INSTALLATION AT THE BELMONT GOLD MINE. D. G. KERR	VI	233–244
Air Compressors, *see also* Compressors		
Brayton Domain Colliery	IX	409
Centre Star Mine, Rossland, B.C.	V	474
Collieries, in	IX	203
Cooling system for	V	158
Indicator Cards. Paper by HARDIE	VIII	285–289
Le Roi mine, Rossland, B.C.	V	327, 406
Rossland Dist., B.C.	VI	182 et seq
Susquehanna Coal Co., Pa.	IX	379

* See Summaries, page 66

	Vol.	Page
Air cylinders:		
Harris air-lift, records	v	271, 272
Ajax silver-lead claim, FERGUSON, B. C.	vii	*98
Akerman, Prof. Richard		
On consumption of charcoal per ton of pig iron in Sweden	ii	46, 47
Report, Swedish iron ores (1876)	ii	39
AL282 gold mine, SEINE RIVER, ONT.		
See Sunbeam Gold Mine.		
Alabama, U.S.A.		
Gas tests on coals from	ix	325
Iron in	x	136
Steam tests on coals from	ix	322
Alamo mine, SLOCAN, B.C.		
Concentrator at	vi	152
	vii	372
Alaska:		
Acquired by United States	v	598
Coalfields	viii	242
Copper deposits. Notes by BREWER	ix	45
	x	199
Alaska Exploration Company:		
Coal mining in Yukon	iv	296
Alaska-Treadwell Company:		
Mine accounts of	iii	51
Alaskite:		
Goldfield, Nev	viii	40-41-44
Alberni, VANCOUVER ISLAND, B.C.		
Copper ore	v	229
Ores	vi	197
Albert Co., NEW BRUNSWICK		
Shales	vi	475
Albert copper mine, CAPELTON, QUE.	v	82
Alberta:		
Coal and Coal Mining:		
BELL, Notes by, (1901)	v	575
DOWLING, report by	x	229-241
Geology, Western	vii	422
Horizons in	viii	222 et seq
Industry (1900)	iv	298
Regulations	v	111
Production (1900)	v	564
(1902)	vi	445, 454
SMITH, F. B., notes by, (1902)	v	105
report by	vi	373 et seq
Alberta Gold Dredging Company	iv	297
Alberta Railway and Coal Co., LETHBRIDGE, ALTA.	v	107
Coal Production (1900)	iv	298
(1901)	v	578
Mining methods	v	108
Railway	v	109
Albertite:		
ADAMS, notes by	vi	475
BAILEY, report by	vi	105
New Brunswick	vi	474
Albion coal mines, PICTOU, N.S.		
Seams	vi	447
Alder:		
Sudbury Dist., Ont.	vii	495

	Vol.	Page
Aldfield Tp., PONTIAC CO., QUE.		
Molybdenite	VI	49
Aldridge, W. H.		
Elected Councillor (1906)	IX	27
Alexander Milling Co., BRANDON, MAN.		
Producer gas plant	IX	324
Alexandria, VANCOUVER ISLAND, B.C.	VI	195
Algoma Central Railway:		
Construction	III	121
Algoma Dist., ONT.		
HILLE, notes on gold deposits	VIII	183
Iron ore resources	IV	279 et seq
***ALGOMA MINING FREAKS.** BRENT	IV	174-179
Algoma Steel Works, Ont.:		
Trade in 1903	VII	425
Algonkian:		
Use of term	V	50
Alien law:		
Notes by WADE	V	601
Alipite	IX	306
Analysis	IX	307, 308
Alkali mine, ASCHERSLEBEN:		
Chain haulage plant	II	185
Alkali-syenite:		
Franklin Camp, B.C.	X	172
Alkalies:		
Manufacture, history of	III	135
Replaced by magnesia, etc., in rocks	II	78
Allan, Sir Hugh	X	168
Allanhurst, Ont.		
Graphite from	X	92
Allanite:		
Ontario occurrences	VII	254
Taché Tp., Que.	IX	73
Allen, A. H.		
Quoted on treatment of titaniferous iron	VIII	153
Allenhurst Graphite Mine, DENBIGH TP., ONT.		
CARTER, notes on, by	VII	161
Allerton Main Colliery, YORKSHIRE:		
Clanny Lamp, cause of explosion, at	V	384, 386
Alloys:		
Aluminium	VI	39
Bismuth	VI	39
Nickel	VI	37
Alluvial Gold: *See* Gold		
Alma mine, POOL CREEK, LARDEAU DIST., B.C.	VII	93
Almaden: *see under* Spain		
Almandine: *see also* Garnet		
Boundary dist., B.C.	V	369
Almeria: *see under* Spain		
Alps, SWITZERLAND:		
Tunnelling in	II	137
Altaite:		
West Kootenay, B.C.	II	76
Alten, HAMMERFEST		
Copper mine	VI	46

* See Summaries, page 30

	Vol.	Page
Altitudes:		
Athabasca mine, Nelson, B.C.	IV	18
Bankhead, Alta	VIII	218
Big Piney, Mt. Oregon, U.S.A.	IV	185
Boisdale Hills, C.B.	VI	412
Butte, Mont.	V	297
Chaminis Hill, Larder Lake, Ont.	X	69
Coal Creek colliery, B.C.	IV	155, 239
Copper Mt., Similkameen Dist., B.C.	V	493
Cordillerano, Oaxaca, Mexico	VIII	272
Crow's Nest Pass, B.C.	IV	232
Dillsboro, N. Carolina	IX	303
Goat River, B.C.	V	76
Kitchener, B.C.	V	76
Laurentian Plateau	VIII	85
Loon Creek Dist., Idaho	IX	55
Mason Valley Mts., Nev.	X	257
Mount Uniacke, N.S.	IV	47
Nettie L. mine, Ferguson, B.C.	VII	97
New Caledonia nickel area	VI	173
Salmon Dist., B.C.	III	4
Selkirk Mts., Lardeau Dist., B.C.	VII	87
Spruce and Pine Valley, Atlin Dist., B.C.	V	21
Webster (near) N. Carolina	IX	304
Windy Arm, Y.T.	IX	51
Alumina:		
Determination of	VI	293
	X	451
Aluminium:		
British Aluminium Co.	III	137
Corundum, possible use in manufacture of	III	202, 203
Foyers, Scotland, manufacture of, at	III	137
Hall & Héroult process	III	137
JOHNSON, statistics by	VI	68
Manufacture of, history	III	137
MILLER, notes on manufacture and uses of	VI	38 et seq
Price	III	137
Production (1897)	III	137
Smelting	VII	276
Sodium process	III	137
Amalgamation: *see also* Milling, Stamp Milling, etc.		
Athabasca mill, Nelson, B.C.	IV	87
Bottom water feed	II	235
Bridge River Dist., B.C. gold-silver ores	III	27
CARTER, notes on Deloro mill, Ont.	VII	120
Crushing for	IV	190
DE KALB, notes on	IV	192
	IX	68–71
Deloro mill, Ont., practice	IV	115
Early Mexican methods	VIII	275
Feed, size of	II	151
Gold ores	II	205
GUESS, H. A., notes on a laboratory device for	I	10–14
Laboratory tests	I	10
Losses, cause of	IV	195
Mercury, regulation of	IV	115
Micmac gold mine, N.S.	VII	318
Mikado mine, Ont.	VII	134

	Vol.	Page
Amalgamation—Con.		
Mispickel	IV	116
Mortar, influence of depth of	II	151
Mountain Lion mill, Republic, Wash	V	278
Oldham gold mine, N.S.	X	435
Ore particles, formula for calculating	II	9
Pelatin-Clerici process	V	275
Rainy River gold ores	VI	334
Silver Cup mill, Lardeau Dist., B.C.	VII	100
Silver ores, Slocan Dist., B.C.	VII	200, 202
Ymir, B.C.	III	9
mill, extraction	III	169
Amber Mica: *see* Mica		
Ambulance Requisites at Collieries:		
Views of F. B. SMITH, on	V	111
American Institute of Mining Engineers:		
Halifax meeting	IV	39
Joint meeting with C.M.I. (1900)	IV	3–67
Sydney, C.B. meeting	IV	21–27
Represented by Dr. Douglas and Dr. Ledoux at first annual meeting C.M.I.	II	212
American Mining Congress:		
Resolution of, respecting fraudulent mining schemes	X	322
Amethystine:		
Thunder Bay, Ont.	VII	140
Amherstburg, ONT.		
Natural gas	III	74
AMI, DR. H. M.		
****On a New and hitherto Unrecognised Geological Horizon in the Gas and Oil region of Western Ontario***	II	183-190
†***On the Possible Occurrence of a Coal Area beneath the Neo-Carboniferous or Permian Strata of Pictou County, Nova Scotia***	V	358-364
Quoted on work of DAWSON	IX	100
Views on ownership of Franklin District	VIII	21
Minor ref.	VIII	19
Ammonia:		
Cobalt-nickel, solubility in	VIII	358, 362
"Ammonites"		
Cascade Coal Basin, Alta	VIII	233
Ammonium Sulphate	VI	390
Amygdaloid:		
Michipicoten, Ont.	VII	147
Anaconda, MONTANA		
Smelting practice at	VIII	349
Anaconda car-axle	V	461
Anaconda Copper Mining Co.		
Smelting plant at	VIII	350
Anaconda mineral claim, ATLIN DIST., B.C.	III	100
Anaconda mineral claim, Sydney Inlet, B.C.	VI	198
Analyses: *see also* Assays		
CRAIG, notes by, on pig iron	X	373
Graphic formulae for recording, notes by BROWNE	X	282
of Iron, methods for rapid	X	446
Wrought iron, testing for corrosion	VIII	48, 50

* See Summaries, page 14
† " " 52

	Vol.	Page
Analyses—Con.		
Andesite:		
Copper Mt., Similkameen Dist., B.C.	V	494
Anthraxolite		
Cap. Rouge	VII	253
Kingston, Ont.,	VII	253
Long Is., Hudson's Bay	VII	253
Mistassini Lake	VII	253
Petitiskapau Lake	VII	253
Sudbury, Ont	VII	253
Arsenious oxide	IV	122
Asbestos		
Broughton, Que	V	346
Italy	V	346
Thetford, Que	V	346
Augite-andesite:		
Copper Mt., Similkameen Dist., B.C.	V	496
Japan and Nevada	V	494
Calcite		
Marble Bay mine	X	250
Cleveite		
Saguenay, Que	VII	247
Chromite		
Coleraine, Que	II	26
Coal		
Bankhead, Alta	IX	261
Cardston, St. Mary River, B.C.	IV	234
Indicating effect of pressure on physical and chemical properties	VII	503 et seq
Tantalus mine, Yukon	X	217
(**Anthracite**)		
Anthracite, Alta	V	106
	VII	424
	VIII	237
Canmore, Alta	VII	424
Queen Charlotte Islands, B.C.	VIII	237
(**Semi-Anthracite**)		
Cascade Creek W., Alta	VIII	237
Goat Creek, Skeena, B.C.	X	224
Morice River, Skeena, B.C.	X	224
Sheep Creek, W. Alta	VIII	237
(**Bituminous**)		
Bankhead, Alta	VIII	217
Blairmore, Alta	V	106
	VI	232
	VII	425
	VIII	237
Bulkley River, Skeena, B.C.	X	224
Cape Breton, N.S.	VIII	237
Coal Creek, Crow's Nest Pass, B.C.	VII	424
	VII	503
	VIII	237
Driftwood Creek, Skeena, B. C.	X	224
Frank, Alta	VII	424
Goat Creek, Skeena, B.C.	X	224
Kettle River, B.C.	VI	226
Michel, B.C.	VII	503, 504

	Vol.	Page
Analyses: Coal (Bituminous)—Con.		
Morrisey, E. Kootenay, B.C.	VI	230, 231
	VII	504
Nicola, B.C.	VIII	237
Vancouver Island, B.C.	VIII	237
(Semi-Bituminous)		
Canmore, Alta.	VIII	237
Morrisey, Crow's Nest Pass, B.C.	VIII	237
(Lignite)		
Collins Gulch, B.C.	VII	424
Cowley, Sask.	VII	424
Lethbridge, Alta.	V	106
	VII	424
	VIII	237
Medicine Hat, Alta.	VIII	237
Mida, B. C.	VII	424
Moose River, Ont.	VIII	237
North Thompson, B. C.	VII	424
Pacific Coast, B. C.	VI	226
Princeton, B. C.	VI	227
Saskatchewan River, Sask.	VI	225
Souris, Sask.	V	106
	VII	424
	VIII	237
River, Sask.	V	105
Coke		
Belt Montana washed coal	IV	235
Brayton Domain Colliery, Eng.	IX	408
Cardiff and Sunshine	IV	235
Connellsville, Pa.	IV	235
Crested Butte, Col	IV	235
Crow's Nest, B. C.	IV	235
Trinidad, Col.	IV	235
Welsh	IV	236
Copper		
Boundary Dist., B. C.	V	172, 516
Copper Cliff mine, Ont.	III	224
Copper Mt., Similkameen Dist., B.C.	V	499
Emma mine, Boundary Dist.	X	190
Franklin Camp, B.C.	X	174
Marble Bay mine, Texada	X	250
Dolomite		
Boisdale Hills, C. B.	VI	431
Feldspar		
Bedford, Ont.	V	246
Gases *see also* Natural Gas		
from Coal	V	180
Mount Etna, Sicily	VI	83
from Wood	V	181
Gold		
Athabasca mine, Nelson, B.C., ore-pulps	IV	83
Belmont mine, Ont., tailings from	II	8
Emma mine, Boundary Dist., B.C.	X	190
Franklin Camp, B. C.	X	174
Graphite		
Buckingham, Que.	X	94
Greenstone		
Copper Cliff, Ont.	V	530

	Vol.	Page
Analyses—Con.		
Hydrocarbon		
Lothians, Scotland	VI	77
Iron and Iron Ores		
Adirondacks, concentrates	X	117
Atikokan, Ont.	V	57
	IX	298, 300
	V	57, 58
Bilbao, Spain	IV	200
Bower mine	IX	133
Canadian and Swedish compared	II	49
Ely, Minn., U.S.A.	VII	338
Holmer mine, Lake Superior	II	50
Kitchener, B.C., (hematite)	V	77, 79
Lake Superior	V	79
Mountain mine	II	50
	V	258
Tubal mine	II	50
Nastapoka Islands, Hudson Bay	V	258
Negaunee, Mich., Regent mines	VII	334
New Caledonia (garnierite)	VI	173
Sydney, C.B. (pig iron)	X	373
Torbrook, N. S.	IX	33
Wabana, N'fld.	IV	63
	V	79
	X	373
Iron Sands		
St. Lawrence River, Que.	IV	92, 93, 94
	X	109
Lime		
Philipsburg, Que.	V	48
Limestone		
Canadian	IV	153, 154
Emma mine, Boundary Dist., B. C.	X	190
Philipsburg, Que.	V	48
Meteorite		
Stockholm	VI	170
Molybdenite		
Giant mine, Rossland, B.C.	VI	48
Ontario	VI	47
Natural Gas: *see also* Gas		
Indiana	VI	101
	X	79
Ohio	VI	101
	X	79
Tilbury, Ont.	X	79
Welland County, Ont.	III	87
Niccolite		
Quebec	II	63
Nickel		
Chibougamau, Que. (pyrrhotite)	IX	221
Copper Cliff, Ont.	V	534
flue-dust	V	546
roasted ore	V	544
Evje, Norway	VII	405
New Caledonia	IX	310
Sudbury Dist., Ont.	V	235
Worthington mine	V	534

	Vol.	Page
Analyses—Con.		
Nickel-Magnesium-Silicates		
Michipicoten, Ont.	IX	307
New Caledonia,	IV	185
Kanala	IX	307, 308
Nakety	IX	307
New South Wales	IX	308
Oregon	IV	185
Riddles	IX	307
Texas, Penn.	IX	307
Webster, N. Car.	IX	307
Nickel matte		
Copper Cliff, Ont.	V	534, 548
Norway	VIII	207
Sudbury Dist., Ont.	V	236
Ozocerite		
Borysław, Galicia, Austria	VI.	77
Peridotite		
Webster, N. Carolina	IX	313
Phlogopite		
Lacey Mine, Ont.	VII	295
Porphyry		
Copper Mt., Similkameen Dist., B.C.	V	496
Pyrite		
Goudreau Lake, Ont.	X	123
James Lake, Michipicoten, Ont.	VII	159
Pilley Island, Nfld.	VI	406
Roasted, cinder from	VI	406
Spanish	VI	406
Pyroxene gangue		
Marble Bay mine	X	248, 250
Pyrrhotite		
Sudbury Dist., Ont.	VI	406
	VII	481
Rocks		
Boundary Dist., B.C., eruptive	X	188
Rainy Lake Region, Ont., Keewatin	III	159
Southern Slocan, B.C.	II	78
Samarskite		
Berthier County, Que.	X	72
Silver		
Franklin Camp, B.C.	X	174
Republic mine, Slocan, B.C.	VII	200
Slag		
Boundary Dist., B.C.	VI	45
Electric furnace	X	132
Slate		
Balfour, Ont., (anthracitic)	III	160
Steel		
Electrically smelted	IX	132, 133
Tested for corrosion	VIII	48, 50
Sulphides		
Accompanying concentrating values	III	107
Uraninite		
Lièvre River, Que.	IX	72
ANALYSIS OF CORUNDUM AND OF CORUNDUM ROCK, GOODWIN.	IV	180, 183

* See Summaries, page 31

	Vol.	Page
***ANALYSIS OF INSOLUBLES,** LAY	v	42, 46
Andalusite:		
Ymir, B. C.	v	525
Andesites:		
Boundary Dist., B.C.	v	367
Andradite: *see* Garnet		
Andree nickel refining process	v	204
Andrews, C. F.		
Discussions by, on		
Acetylene Gas as a Mine Illuminant	II	231, 232
Description of the Sultana Quartz Lode	II	237, 238
The Gold Measures of Nova Scotia and Deep Mining	II	246
Improved Method of Feeding Water to the Stamp Mill Mortar	II	233, 235
Andalusia: *see under* Spain		
Anglo-Canadian Graphite Syndicate:		
Mill of	x	92, 93
Anglo-Canadian Lead Syndicate Ltd.	IV	308
Aniline Dyes:		
MILLER, notes by	VI	33
Animikie formation:		
Cape Jones, Labrador	IX	127
Dorion Tp., Ont.	VII	156
Incorrectly correlated by American geologists	VII	258
Iron ores, notes by WILLMOTT	VII	258
Silver veins in	VII	140
Western Ontario	v	50
Animikie Iron Range, ONT.		
HILLE, paper by	VI	245, 287
WILLMOTT, notes by	VII	257
Anna-Eva claims, TELKWA RIVER, B.C.	x	222
Annapolis County, N.S.		
Iron in	IX	31, 34
Annapolis Iron Company Ltd.		
Property of	IX	31
Anodes:		
Blister copper	II	226
Gold and silver values in copper	II	227, 228
Hall mines smelter, Nelson, B.C.	II	226
Anorthosite:		
Corundum occurrences in	VII	417
Anthracene:	v	145
Anthracite: *see also* Coal		
Alberta production (1900)	IV	298
Canadian imports (1900)	v	565
Consumption and price in Manitoba (1899-1900)	IV	299, 300
Crushing	IV	208, 210
Dust, method of coking	IX	327
Gas-producer plant	IX	324
Screening	IX	261
Whitehorse, Y. T.	x	216

* See Summaries, page 39

	Vol.	Page
Anthracite, ALBERTA		
Coal: Analysis	VIII	237
	V	106
	VII	424
discovery of	VIII	233
hardness of	X	232
mines	V	107-9-10
	VI	373
	VIII	233
mining at	V	110
production (1900)	IV	298
(1901)	V	578
(1902)	VI	454
seams	VIII	228
	X	232
Fault line near	VIII	227
Pitch, variations in	II	17
ANTHRACITE BREAKER OF THE PACIFIC COAL CO. LIMITED, BANKHEAD, ALTA. STOCKETT & WARDEN	IX	261, 271
Anthraxolite:		
Analyses	VII	253
Notes by MILLER	VII	255
Anticline:		
Boisdale Hills, C. B.	VI	411, 434
Cascade Coal Basin, Alta.	VIII	221
Iron Range, Nipissing Dist., Ont.	IV	276
Kimberley, B. C.	V	513
Nova Scotia gold measures	II	121-123
Antidote:		
Arsenic fumes	V	241
Antimony:		
Assaying	IV	225
Canadian statistics (1902)	VI	454
First used	VI	35
Quebec production (1901)	V	572
San Juan, Vancouver Island, B.C.	V	230
Slocan Dist., B. C., in dry ores	V	12
Ochre:		
Conrad, Y. T.	X	212
Apatite: (PHOSPHATES)		
Canadian statistics (1901)	V	572
(1902)	VI	455
Effect of, in concentration of iron ore	VI	9
Igneous nature	VI	76
Occurrence, notes by MILLER	VI	42
Ontario		
Depth of mines	VII	295
Industry	VII	161
Occurrences	VII	387
Quebec		
Depth of mines	VII	295
Production (1900)	V	350
Statistical notes by JOHNSON	VI	71

Apcheron, *see under* Russia
Apennines, *see under* Italy

* See Summaries, page 121

	Vol.	Page
Apex law:		
Ontario and British Columbia, abolishment of	III	112
Aplite:		
Athabasca mine, Nelson, B.C., dyke	V	16
Frontenac Co., Ont.	VII	215
Lardeau Dist., B. C.	VII	90
Texada Island, B. C.	X	249
Appalachian Mts.		
Iron ores	VII	273
Mica Occurrences	VII	287
Oil and gas fields	VI	100, 104, 109, 110
Aranzuzu, MEXICO		
Copper, occurrence	X	254
Arbitration:		
For settlement of labour disputes, FERGIE'S views on	VI	450
Arbuckle Mt., BRUNSWICK DIST., ARK., U. S. A.		
Bitumen deposits	VI	105, 113
Archean:		
Atikokan, Ont.	IX	287
Boisdale Hills, C. B.	VI	414
Boundary Dist., B. C.	V	514
Canada, notes by MILLS on rock movements	VII	177
Carbon contained in rocks of	VI	75
Frontenac Co., Ont.	VII	211 et seq
Graphite deposits in	X	87
Minnesota, U.S.A.	VII	336
Natural gas and petroleum in	II	210, 211
New York State, U.S.A.	VI	112
Nomenclature of formations under	VI	256, 257
Norway	VII	401
Ontario Southwest, natural gas in	III	80
Western	V	50
notes by BRENT	VI	327
Rainy River Dist., Ont.	VII	126
Salmon River Dist., B. C., complex rocks	III	4
Sudbury Dist., Ont.	V	235
Webster, N. Carolina	IX	304, 311
West Kootenay, B. C.	V	506
Shuswap series	II	72
Archeluta Co., COLORADO, U.S.A.		
Bitumen	VI	77
Arctic Chief copper claim, WHITEHORSE, Y. T.	VIII	177
	X	198, 216
***ARE THERE DIAMONDS IN ONTARIO?** BLUE	III	149, 160
Discussion on, by ADAMS, BARLOW, COSTE, GOODWIN, LOW	III	195, 196
Areal Geology:		
Canada	V	586
Argentite: *see also* Silver		
Algoma Dist., Ont.	IV	175
Atlin Dist., B. C.	III	99
Cobalt Dist., Ont.	X	67
Conrad Mining Div., Y. T.	X	211
Slocan Dist., B. C.	V	12
Thunder Bay, Ont.	VII	140
West Kootenay, B. C.	II	75
Windy Arm, Y. T.	IX	50

* See Summaries, page 23

	Vol.	Page
Argenteuil County, QUE.		
Graphite in	x	86
Argillite:		
Boundary Dist., B. C.	v	365, 366
Franklin Camp, B. C.	x	171
Lardeau Dist., B. C.	vii	89
Arizona, U. S. A.		
Copper, Triassic sandstone	iv	125
Secondary enrichment in	x	56
of copper at	x	252
Arkansas, U. S. A.		
Bitumen deposits	vi	105
Arkansas Valley Smelting Works:		
Practice at	ix	58
Arlington Mine, SLOCAN DIST., B. C.	iii	3
	v	11
Vein	v	12
Armour Plate:		
Composition	vi	63
Armstrong, N. T.		
Reference	vii	413
Arnold Hill iron mines, NEW YORK, U.S.A.		
Magnetic concentration	iv	16
Arnold River, EASTERN TPS., QUE.	vii	398
Arquerite:		
Omineca Div., B. C.	x	228
Arrastra:		
Los Reyes gold mines, Mexico	viii	275
Treatment of tailings from	viii	283
Arrhenius, Svante:		
Theory of, respecting composition earth's core	x	303
Views on rock pressure	vi	99
Arrow Creek, GOAT RIVER, B. C.	v	76
Arrow Lake, BRITISH COLUMBIA		
Relation of dykes to ore bodies	ii	83
Arsenic: *see also* Mispickel		
Canadian production, note by JOHNSON	vi	71
statistics (1902)	vi	454
Deloro mine, Ont.	iv	113
Effects of, on segregation of precious metals in copper bars	ii	110, 113
Ontario		
Industry, notes by MILLER	v	241
Manufacture and production	iv	122
Production (1900)	iv	303
(1901)	v	581
(1902)	vi	464
(1903)	vii	390, 430
Statistics (1899-1903)	vi	121
Recovery of, from Cobalt ores	x	75
Vancouver Island, B. C.	v	231
West Kootenay, B. C.	ii	75
Arsenic works, DELORO, ONT.	iv	113, 122
Arsenides:		
Cobalt-nickel-silver discovery	vii	142
Nickel-cobalt-copper, electrolytic refining	v	204
Nickel, Nevada, U. S. A.	iv	185

Arsenious Oxide, *see* Arsenic

Arsenopyrite:	Vol.	Page
Amalgamation	IV	116
Attraction of, for oil	VII	187
Auriferous, treatment	IV	113–122
Boundary Dist., B. C.	V	368
Conrad, Y. T.	X	211
Crushing	IV	208-10-13
Deloro mine, Ont.	IV	113
treatment of auriferous	IV	143 et seq
Hastings Dist., Ont.	V	240
Poplar Creek Dist., B. C.	VII	104, 106
Rainy River Dist., Ont.	VI	334
Rossland, B. C.	V	522
West Kootenay, B. C.	II	76
Windy Arm, Y. T.	IX	51
Artesian wells:		
Montreal Island, Que., paper by ADAMS	VIII	76–97
Oahu, Hawaiian Islands	VII	76
Texas oilfields	VI	104
ARTESIAN AND OTHER DEEP WELLS ON THE ISLAND OF MONTREAL, THE. ADAMS	VIII	76–97
Discussion by DRESSER, ADAMS, BRAINERD, SMITH, B., COSTE, TAYLOR	VIII	97–101
Asbestic:		
Canadian production (1901)	V	570
Quebec production (1898)	II	65
(1900)	V	350
†***ASBESTOS AND ITS PRODUCTION IN CANADA,*** W. MOLLMANN	V	343–357
Asbestos:		
Application and uses, notes by MILLER	VI	44
Canadian compared with Italian	V	346
statistics (1901)	V	570
(1902)	VI	454
(1906)	X	12
Chemical composition	V	343
Grading	IV	8
	V	351, 354
Industry of, notes on by JOHNSON	VI	71
MOLLMANN, paper by on Canadian	V	343, 357
Petrography	V	346
Prices	V	355
Properties of	V	343
Prospecting for, note by DRESSER	VIII	269
Separating process	IV	7
Statistics (1879-1901)	V	350
Veins	V	351
Ontario		
Hastings Co.	VII	167
Ottawa valley	II	64
New Caledonia	VI	170
Quebec		
Broughton	II	64
Chibougamau Dist.,	IX	19
	X	105
notes by CIRKEL	VIII	367
OBALSKI	VIII	365
	IX	219

* See Summaries, page 95

† See Summaries, page 52

	Vol.	Page
Asbestos—Con.		
Danville	II	64
Industry (1900) notes by BELL	IV	304 et seq
(1901)	V	581
Operations (1898)	II	64
Production (1898)	II	65
(1899)	III	187
(1900)	IV	305
	V	350
Thetford	II	64
methods of mining	IV	7
Siberia	VI	372
United States	V	347, 350
Asbestos Island, CHIBOUGAMAU, QUE.		
Serpentine on	VIII	365
Ascot, SHERBROOKE CO., QUE.		
Copper-bearing rocks at	VII	398
	VIII	260
Ascot mineral belt, EASTERN TPS., QUE.	V	82
Ash:		
Cape Breton, in coke	IV	136
composition	IV	141
Ash Wood:		
For Charcoal	II	47
ASHWORTH, JAMES		
****Safety Lamps and Colliery Explosions***	V	379–392
Notes by, on safety lamps and colliery explosions	VI	206–213
Ashworth-Hepplewhite-Gray Lamp:		
Description	V	390 et seq
	VI	213
HARDIE, notes by, on	VI	203
Photographs of	VI	208–9
Askim: *see under* Norway		
Aspen Grove, NICOLA DISTRICT, B. C.		
Copper ores	IV	229
Asphaltum (MINERAL TAR):		
COOPER, notes on origin, by	VI	96
Occurrence	VI	89
PARKER, notes by, on	VI	95
Assay furnace:		
BRENT, paper by, on	V	288–295
Lining	V	289
Products	II	227
Assay office:		
Government, maintenance of	V	132–151
Governmental, notes by HARDMAN	V	114
Assay sheets:		
of Centre Star Mine, Rossland, B. C., description	VIII	334
Assayers:		
Government examinations for	III	143
Assays and Assaying: *see also* Analyses		
Barium sulphate	V	43
Bullion, gold and silver	II	112, 113
Copper, boring and core samples	IX	320
Mt. Sicker, V.I., B.C.	IX	46
Chromite	V	45
Corundum, notes by GOODWIN	IV	180–3

* See Summaries, page 54

	Vol.	Page
Assays and Assaying—Con.		
Deloro, Ont., laboratory	IV	122
Drill cores	IX	319
Electricity, effect on	VI	471
Fluxes	V	42 et seq
Gold:		
Keewatin mine, Ont.	II	240
Maiden Island, Ont.	II	239
Pine Portage mine, Ont	II	239
San Juan, Vancouver Island, B. C.	V	230
Savant Lake, Ont.	VII	118
Sultana mine, Ont.	II	239, 240
Vermilion River, Ont. (sands)	II	106
Yukon, bank charges on	III	214
Greenwood smelter methods	IX	360
Iron, Kitchener, B. C.	V	77
Lead:		
Fire, not reliable for	III	171
Losses in	IV	226
Notes on, by LAY	IV	224–229
Molybdenum	VI	60
Nelson, B. C., Athabasca mill products	IV	86
Nickel:		
Douglas Co., Oregon	IV	187
Norway	VII	404
Oil furnaces for, paper by BRENT	V	288–295
Platinum:		
Tulameen, B. C.	VIII	200
Vessels of, when to use	V	43
Prospectors' expenses for, allowed as "assessment work"	III	199
free to	V	136
Pulp:		
for check purposes	III	17
residues	IV	193
Silica	V	43
Titaniferous iron	V	44
Tailings	IV	193
"Assessment Work"		
COSTE's views on	VII	450, 451
to Include assaying charges	III	199
Ontario	III	112
United States' regulations	VII	475
West Kootenay, B. C.	III	143
Yukon	IX	120
Assiniboia:		
Now merged into Saskatchewan, *which see*		
Asturias: *see under* Spain		
Athabasca mill, NELSON, B. C.		
Assay practice	IV	86
Description	IV	84–87
Stamps, weight of	IV	85
Athabasca mine, NELSON DIST., B. C.		
Gold-milling practice, paper by FELL	IV	83–90
Gold yield from	V	20
Notes on, by FELL	V	15 et seq
Ore	IV	83
Athabasca River, ALTA.		
Coal on	X	236

	Vol.	Page
Atikokan, ONT.		
Dykes	v	57
Iron ore	v	51
Atikokan Iron Range, SEINE RIVER DIST., ONT.	iv	282
***ATIKOKAN NICKELIFEROUS PYRRHOTITE DEPOSITS AND THEIR ORIGIN.** HILLE	ix	285–301
Atikokan River, SEINE RIVER, ONT.		
Dykes along	ix	291
Iron mining on	vii	154
ATKINSON, M. B.		
†*A Few Features of Mining in the Regent Group of Mines, Negaunee, Mich.*	vii	319–334
Atlas:		
Canada, notes by WHITE, on	vi	320
Atlas Arsenic Co., MARMORA TP., ONT.	iv	303
CARTER, notes by, on	vii	120
Atlas Gold and Arsenic Co., DELORO, ONT.	v	241
Atlin Dist., B. C.		
Access to	iii	101
Climate	iii	101
Characteristics of, paper by GWILLIM	v	21–32
Discussion on, by COSTE	iii	205–207
GWILLIM	iii	97–101
First mined in 1898	v	32
Geology	iii	205
Gold-bearing area	iii	98
mining in (1900)	iv	294
yield	v	32
Gravels, value of	iii	205
Miners' wages	iii	101
Mining division, discovery	iii	97
Molybdenite	vi	49
Quartz mining	iii	99–101
ROBERTSON, notes by	v	573
Size of claims	iii	205
Timber	iii	101
Topography	iii	101
	v	21
Atlin Lake, B. C.		
Native copper	iii	100
Aubury, Louis	x	335
Quoted on Clover Creek quicksilver mine	ix	282
Augite:		
Replaced by pyrite	v	521
Augite-andesite:		
Copper Mt., Similkameen Dist., B. C., analysis	v	496
Japan and Nevada, analyses	v	494
Augite-diorite (MONZANITE)		
Rossland, Dist., B. C.	v	448
Augite-porphyrite(s) (SO-CALLED FELSITE)		
Boundary Dist., B. C.	v	366
Lardeau Dist., B. C.	vii	89
Rossland Dist., B. C.	v	450, 451
	vii	49
Texada Island, B. C.	viii	175

* See Summaries, page 123
† " " 84

	Vol.	Page
Austen Bay, TIMAGAMI DIST., ONT.		
Jaspilyte	IV	278
Australasia:		
Coal production, 1898-1900	VI	31
Australia:		
Bendigo Goldfield:		
Amplitude of folding	II	121
Compared with Nova Scotia gold area	II	121
Depth at which gold is profitably mined	II	165
Discovery	VI	26
Production (1851-1900)	VI	25
Saddle Reefs	IV	45, 48
Copper mining	VI	34
Iron trade in	VIII	160
Kalgoorli		
Gold discovery	VI	27
Mining laws in	VII	466
Austria:		
Graphite statistics	X	101
Iron production (1899)	III	120
Austria-Hungary:		
Coal production (1850-1900)	VI	31
Gold production (1801-1900)	VI	25
Iron and steel production (1807-1900)	VI	29
Auvergne: *see under* France		
Axle:		
Mine car	V	461
Azurite (blue carbonate of copper):		
Conrad, Y. T.	X	211
King Solomon mine, Boundary Dist., B. C.	V	375
Yerington, Nev.	X	259

B

Babine Range, SKEENA RIVER, B. C.	X	221
Babu, M. L.		
Report by, on Galician (Austria) oilfields	VI	108
Baddeck District, N. S.		
Gypsum in	IV	312
Badger silver mine, THUNDER BAY, ONT.	VII	141
Badshot mineral claim, LARDEAU DIST., B. C.	VII	101

	Vol.	Page
Baer, G. F.		
Address by, at Halifax meeting of Institute	IV	55–57
Baffinland:		
Copper prospects	VIII	22
Glaciation in	IX	125
Bagot, Sir Charles	IX	88
Baie des Guize, QUE. (Lac des Quinze)	X	106
Bailey, Dr.		
Report by, on New Brunswick albertite	VI	105
Bailey, Prof. L. W.		
Quoted on St. Stephen nickel deposits	IX	238, 239
BAKER, M. B.		
Discussion by, on Magnetic Concentration	VII	281
Some Gold Deposits in Eastern Ontario	VII	243, 244
Paper by,		
On the Occurrence and Development of Corundum in Ontario	VII	410–424
Bakou, CASPIAN SEA: *see under* Russia		
Bald Indian Bay, ONT.	II	87
Balfour, ONT.		
Possibility of finding diamonds at	III	160
Ball, Clinton M.		
Magnetic separation of iron ore	X	262
Ball-mill:		
Crushing efficiency of	IV	207
notes on, by PORTER	IV	212, 221
Ball-Norton separator:		
Notes on by WELLS	VI	14
Balm Well Spring, ST. CATHERINE, SCOTLAND	VI	79
Bandsept gas-burner:		
Description	IV	138
Bankhead: *see* Tipple		
Bankhead, ALBERTA		
Coal:		
Character of	X	232, 238
Efficiency of, for fuel	IX	325
Seams	VIII	231
	X	232
Section of mine	VIII	230
Structure of coalfield	VIII	224
†***BANKHEAD COAL MINES.*** HENRETTA	VIII	215–220
Banner claim, FRANKLIN CAMP, B. C.	X	174
Bannockburn, MADOC TPS., HASTINGS CO., ONT. *see also* Hollandia Lead Mine		
Pyrite	V	242
Barbados:		
Asphaltum deposits	VI	89

* See Summaries, page 87
† " " 101

	Vol.	Page
Barclay Sound, VANCOUVER ISLAND, B. C.		
Copper	v	229
Iron ores	vi	199
Barite: *see* Baryte		
Barium sulphate:		
Assaying	v	43
BARLOW, DR. A. E.		
Discussions by, on Are There Diamonds in Ontario?	iii	195
The Distribution of Platinum Metals in sources other than Placers	viii	212
The Exploration of Ontario Iron Ranges	vii	264
The Geological Survey as an Educational Institution	vii	445-448
Magnetic Separation	vii	279
The Ore Deposits and Geology of the Sudbury Dist., Ont.	ix	228, 230 231, 232 233, 234
The Ore Deposits of Rossland Dist., B. C.	vii	63
The Undeveloped Mineral Resources of Ontario	vii	396
On Iron Ore Deposits of Lake Timagami	iii	192
Elected Councillor C.M.I. (1905)	viii	34
(1906)	ix	27
Paper by:		
On the Nickel Deposits of Webster, North Carolina	ix	303–316
Petrographical determinations by, Texada Island, B. C.	viii	175
Report on Nipissing and Timiskaming region	vi	75
Quoted on origin Sudbury ores	ix	294
Minor refs	viii x	10 69, 107, 121, 275
Barometric pressure:		
Coal Creek, B. C.	iv	239
Effect of, on gas explosions	vi	205
In collieries, effects of	v	392
Baron Girar de Soukauton Asbestos mine, RUSSIA	vi	372
Barr, Wm. M.		
Description of air-pump, by	vii	528
Barrande, Joachim	x	360
Barrie Tp., FRONTENAC CO., ONT.		
Formation	vii	211
Map	vii	236
Bartlett table:		
Deloro Mill, Ont	iv	118
Bartlett-Thompson nickel process, (ORFORD)		
Notes by KOEHLER	v	192, 212
Notes by ULKE	v	393

* See Summaries, page 123

	Vol.	Page
Barytes:		
Canadian statistics (1902)	VI	454
Cap Rouge, N. S.	IV	312
Compounds of	VI	44
Concentration of	III	108
Production:		
Nova Scotia (1899)	III	189
Quebec (1898)	II	65
(1900)	V	350
Basalt:		
Richmond Mt., Eureka Dist., Nevada, analysis	V	496
BASIC OPEN-HEARTH STEEL MANUFACTURE, AS CARRIED OUT BY THE DOMINION IRON AND STEEL COMPANY, AT SYDNEY, C.B.		
LATHE	X	373–396
Basque, John	X	357
Basque Province, SPAIN		
Iron Ore	IV	196
Bass River, COLCHESTER CO., N.S.		
Tripolite from	IV	312
Basse (and Selve) Nickel Refining Process	V	205
Bastite:		
Atikokan, Ont.	IX	291
Batchawana Bay, ALGOMA DIST., ONT.		
Jaspilyte	IV	279
Batchawana Iron Range, ONT.	VII	257
BATEMAN, G. C.		
Discussion by, on Canadian Metallurgical Products for the Far East	VIII	161
Paper by,		
†***Notes on Graphite, its Occurrences, Uses and Production***	VIII	343–347
Bates Belt Conveyer:		
Description	III	34
Bather, PROF. F. A.		
Quoted on functions of museums	VIII	68
Battery: *see* Stamp-battery, Milling, Stamp-mills		
Battle River, PEACE RIVER, ALTA.		
Coal on	X	236
Bauxite:		
Aluminium manufacture, price of	VI	38
Bawden, J.		
Paper by, on Economics of Joint Stock Companies; referred to	X	322
Bay Farm furnace, MICH.		
Charcoal consumption	II	46
Bay of Fundy, N. B.		
Graphite near	X	86
Beach wood:		
For charcoal	II	46
Bear iron claim, GOUDREAU LAKE, ONT.	X	122
Bear Lake, OMENICA DIST., B. C.	III	90
Gold	III	95
Bear River, BEDWELL SOUND, V.I., B. C.	VI	189
Bear River, SKEENA RIVER, B. C.	X	220
Beaton, ARROW LAKE, B. C.	VII	87

* See Summaries, page 147
† " " 107

	Vol.	Page
Beatrice Creek, LARDEAU DIST., B. C.	VII	93
Beatrice mine, MOHAWK CREEK, LARDEAU DIST., B. C.	VII	97
Beatson copper mines, LA TOUCHE ISLAND, ALASKA		
Ore deposit at	IX	44
Beatty, George		
Minor Ref.	VI	300
Beauce County, QUEBEC		
Gold in	VIII	259
Mineral claims of	II	243
Beche, Sir Henry de la		
Beck, Dr. Ludwig		
Ref. to work on History of Iron	VI	28
Beck, R.		
Quoted on origin of pyrite	X	118
Sohland nickel deposits	IX	240, 256
		259
***BED-ROCK OF THE GILBERT RIVER GOLD-FIELDS, QUEBEC, THE.** DRESSER	VIII	259, 262
Discussion by Coste, Blue, Dresser, Hardman, Goodwin Ingall	VIII	262–266
Bedford Tp., FRONTENAC CO., ONT.		
Feldspar mining in	V	246
	VII	165
Belding Paul & Co.	VIII	90
"Belemnites":		
Cascade Coal Basin, Alta.	VIII	233
Belgium:		
Coal:		
Mining methods	IV	128, 129
Production (1850–1900)	VI	31
Iron production (1899)	III	120
and steel production (1854-1900)	VI	29
Bell, Rev. Andrew	IX	91
BELL, B. T. A.		
Address, Sydney, C. B.	IV	20
Death of	VII	2-10-12
		20
	VIII	4
Discussion by, on A Description of the Sultana Quartz Lode and the Sinking of the Burley Shaft on Bald Indian Bay	II	243
The Gold Measures of Nova Scotia and Deep Mining	II	249
The Influence of Government on Mining	VI	364, 371
The National Importance of Mining	V	590–3
The Small Economies of Mining	III	170
Elected Secretary C.M.I. (1898)	I	18
(1899)	II	252
Reports by, as Secretary (1900)	IV	287 et seq
(1901)	IV	69
		287–293
	V	557
Reviews by, of Canadian mineral industry (1900)	IV	292
(1902)	VI	453

* See Summaries, page 104

	Vol.	Page
BELL, B. T. A.—Con.		
Views of, on Canadian Mining Institute, objects	III	247
Civil Engineer's Bill	II	255
	V	561
Geological Survey, officer's salaries	IV	71
work of	V	590
Mineral Statistics, compilation	VI	460
publication	II	255
Nickel export duty	III	240, 241
Minor Ref.	VI	479, 481
	VIII	366
	IX	22
		219, 233
	X	125, 152
Bell graphite mine, BUCKINGHAM, QUE.	X	92
Bell Island, NEWFOUNDLAND		
Area	IV	63
Iron mines	IV	35
		63–67
ore discoveries, geology	II	66
Bell, Sir Lothian		
on Charcoal per forest acre	II	47
Bell River, NOTTAWAY RIVER, QUE.	X	107
Huronian formation on	IX	219
BELL, DR. ROBT.		
Appointed Acting-Director Geological Survey	IX	100
Discussion by, on The Bruce Mines, Ont.	X	168, 169
Magmatic Waters	X	313
The Undeveloped Mineral Resources of Ontario	VII	394
The Volcanic Origin of Natural Gas and Petroleum	VI	126, 128
Helen iron formation, report by, referred to	X	126
Hudson Bay, iron ore, report by, referred to	II	214
James Bay formations, quoted on	VII	175, 387
Papers by, on		
**Advantages of Combining Topographical with Geological Surveying in Unexplored Regions, The*	VIII	56–58
†*Cobalt Mining District, The*	X	62–68
‡*Occurrence of diamonds in the drift of some of the Northern States*	IX	124, 127
‖*Sir William E. Logan and the Geological Survey of Canada*	X	342–370
Views of, on:		
Canadian Geological Survey, work of	V	590
Mineral statistics, compilation	VI	460
Minor Refer.	VIII	366
	IX	22, 219, 233,
	X	125, 152
Bell, Wallace	VIII	77
Bell, William	VIII	77
Belle Plain, near REGINA, SASK.	VIII	241

* See Summaries, page 93
† " " 128
‡ " " 115
‖ " " 147

	Vol.	Page
Belleville, ONT.		
Govt. assay office	V	138
Bell's Asbestos Co., THETFORD, QUE.		
Mine, methods of working	IV	7
Belly River, ALTA.		
Geology	VII	422
Coal Field, ALTA.		
Coal of, analyses	VII	424
Description of, by DOWLING	X	233 et seq
Series		
Alberta	VIII	221
Occurrences, Lethbridge, Alta	VII	422
Saskatchewan	X	233
Quality of coal found in	X	230, 233 234 et seq
Belmont Tp., PETERBOROUGH CO., ONT.		
Gold mine:		
Air compression at, paper by KERR	VI	233, 244
CARTER, notes by, on	VII	120
Cyanide plant	VII	241
Formation at, notes by KNIGHT	VII	215
MILLER, notes by, on	V	240
Mining and milling operations	IV	303
Tailings, screen analysis of	II	8, 11
Gold occurrences, paper by KNIGHT	VII	210, 244
Iron ore	IV	268
Water power	VI	233
Belt, MONTANA		
Coke analysis	IV	235
Ben D'Or gold mine, BRIDGE RIVER DIST., B. C.	III	27, 28
Mortar at mill of	II	36
Mineral claims	III	25
Bench Gravels:		
Klondike localities	III	124
Values in	III	212
Bendigo: *see under* Australia		
Bengal: *see under* India		
Bennett, George	VII	305
BENNIE, P. McN.		
****Magnetic Concentration of Iron Ores by the Grondal Process***	X	261–273
Benson iron mines, MINEVILLE, U. S. A.		
Magnetic concentration	IV	16
Benzine: *see* Petroleum, Oils and Benzolene		
Benzol:		
Uses	VI	33
Benzolene: *see also* Mine Illuminants		
Use of, in safety lamps	VI	207
Berlin, GERMANY: *see under* Universities, *under* Germany		
Berlin copper claim, BUTTE, MONTANA		
Copper-glance at depth in	X	252
Bertelett screen:	II	5
Berthelot:		
Quoted on carbon forms in magma	VI	75
Berthier County, QUE.		
Radium containing minerals	VII	245
Samarskite	IX	72

* See Summaries, page 143

	Vol.	Page
Beryl:		
Found in Ontario	VII	386
Bessemer converter:		
Use of, in steel mfg.	X	395
Bessemer iron ore:		
Negaunee, Mich.	VII	332
Standard	VI	7
Bessemer matte:		
Sudbury, Ont., nickel ores, composition	V	236
Bessemer process:		
Invention of	VI	29
Spanish iron ores in	IV	197
Swedish iron ores in	II	40
Bessemer steel:		
Corrosion of	VIII	48
Pipe made from	VIII	52
BEST, W. F.		
***Notes on the Economic Minerals of Vancouver Island, B. C.**	V	228–232
Bethlehem Iron Company:		
Iron ore supplies	IV	25
Betsiamits, QUE.		
Iron sands, analysis	IV	92
Bibliography:		
Mica, Canadian occurrences	VII	303
Molybdenite	VI	64
Bichromate:		
Manufacture of	IX	36
Uses	IX	37
Biddle, Henry J.		
Report by, on Webster nickel deposits, referred to	IX	304
Bielenberg, Ernest:		
Death of	IV	288
Big Cave, BRUCE MINES, ONT.	X	155
" Big Coal Seam:"		
Saskatchewan River, Sask.	X	234, 235
Big Hollow, DUDSWELL TP., QUE.	VIII	260
Big Island, *near* EDMONTON, ALTA.		
Coal on	X	237
Big Master gold mine, RAINY RIVER, ONT.		
Notes by CARTER	VII	132, 138
Big Master mineral claim, MANITOU, ONT.	VI	331, 332
Big Muddy Creek, SASK.		
Coal on	X	237
Big Piney Mt., DOUGLAS CO., OREGON		
Nickel occurrences	IV	185
Big Thing mineral claim, WINDY ARM, Y. T.		
Reference	IX	52
Vein on	X	211
Bighorn Coalfield, ALTA.		
Coal seams	X	231, 232
Bilbao: *see under* Spain		
"Bilbo"		
Origin of term	IV	197
Bingham, NEV., U. S. A.		
Copper occurrence	X	255

* See Summaries, page 47

	Vol.	Page
Biography:		
FERNIE, W.	IV	231
Biotite: *see also* Mica		
Associated with Muscovite	VII	305, 306
Methuen Tp., Ont.	VII	305, 306
Biotite-diabase:		
Sohland, Germany	IX	254
Birch:		
Sudbury Dist., Ont.	VII	495
Birch Creek, ATLIN DIST., B. C.		
Notes on, by GWILLIM	V	26 et seq
Birdseye Formation:		
Eastern Ontario	VII	211
BIRKINBINE, JOHN		
Elected Honorary Member C.M.I.	I	17
Paper by, on:		
****Old and New Iron Industry Compared***	V	218–227
†***Supplies and Reserves of Iron Ores***	X	134–148
Bisbee, ARIZONA		
Copper, occurrence	X	254
Biserk District: *see under* Russia		
Bismuth:		
Assaying	IV	225
Uses, notes by MILLER	VI	39
Bismuthinite:		
Boundary Dist., B. C.	V	369
Rainy River Dist., Ont.	VI	334
West Kootenay, B. C.	II	75
"Bisulphite Liquor:"		
Manufacture of	VII	481, 488
Bits:		
Machine drill	V	466
Bitumen:		
Auvergne, France	VI	86
HUNT, notes by	VI	114
Indian territory, U.S.A.	VI	113
Occurrence in igneous rocks	VI	77
Volcanic	VI	86
Bituminous coal: *see also* Coal		
Alberta production (1900)	IV	298
Coke yield, per ton	IV	138
Composition	IV	135
Consumption and price in Manitoba (1899-1900)	IV	299–300
Crowsnest Pass, B. C.	IV	156
Gas yield, per ton of	IV	138
Biwabik formation, MESABA IRON RANGE	VI	249, 251
Black Bay, LAKE SUPERIOR, ONT.		
Copper mining	VII	147
Black Bear mine, ROSSLAND, B. C.		
Tunnel	V	403, 404
"Black dykes":		
S. E. British Columbia	V	508
Black Donald graphite mine, RENFREW CO., ONT.		
Notes by CARTER	VII	160, 161
Black Eagle gold mine, LAKE OF THE WOODS, ONT. *see* Regina Gold Mine	VI	322

* See Summaries, page 47
† " " 133

	Vol.	Page
Black Hills, SOUTH DAKOTA, U.S.A.		
Mica	VII	287
"Black-Jack" *see* Zinc		
Black Jack claim, DOMINION BASIN, SKEENA, B.C.	X	221
Black Jack gold mine, RAINY RIVER DIST., ONT.	VI	332
Black Lake Dist., QUE.		
Asbestos production (1900)	IV	305
Chromite	IX	35–38
production (1899)	III	187
(1900)	IV	308
Black Lake Chrome & Asbestos Co.		
Property and equipment of	IX	35, 36
Black Powder:		
Objections to use of, in coal mines	I	4
Black Prince mineral claim, LARDEAU DIST., B. C.	VII	101
Black Prince mineral claim, SYDNEY INLET, V.I.	VI	198
Black Rock claim, BUTTE, MONTANA	X	255
Black River, LAKE SUPERIOR, ONT.		
Formation	VII	211
Molybdenite	VI	50
Blackfoot Reserve, ALTA.		
Coal at	X	236
Blacksmith Shop:		
Coal Creek Colliery, B.C., charge account	IV	173
Costs, how chargeable in mine accounting	III	66
Le Roi mine, Rossland, B. C.	V	338
Blackwell Tunnel, THAMES, ENGLAND	V	161
Blackwood Brook, NEW GLASGOW, N. S.		
Coal-bearing shales	V	358
Blairmore Coalfields, ALTA.		
Coal analyses	V	106
	VI	232
	VII	424
	VIII	237
measures	VI	225–31–2
production (1902)	VI	454
Geology	VII	422
Mines in	V	108
Mining in 1902, report by F. B. SMITH	VI	374
Thickness of seams in	VII	423
Blake crushers	II	30
	IV	256
Blake-Morscher concentrator:		
Lead-zinc	VI	12
notes on, by WELLS	VI	19
BLAKEMORE, W.		
on Development of Canadian coal industry	IV	75–76
Discussion by, on:		
The National Importance of Mining	V	589, 590
Safety Lamps and Colliery Explosions	VI	200–202
West Kootenay notes	III	199
Elected Councillor C.M.I. (1898)	I	18
Papers by, on:		
****Experiments with Compressed Cartridges***	I	3–9
†***Future of the Coal and Coke Supply of British Columbia, The***	VI	224–232

* See Summaries, page 1
† " " 65

	Vol.	Page
BLAKEMORE, W., Papers by—Con.		
**Iron Ore Deposits near Kitchener, B. C.*	v	76–80
†*Pioneer Work in the Crow's Nest Coal Areas.*	iv	230–243
on Railway construction in British Columbia	vi	224 et seq
Views on Civil Engineer's Bill	v	561
Fernie colliery explosion	vi	201
Minor ref	i	17
Blanche River, LOCHABER TP., QUE.		
Graphite mining on	x	90
Blast:		
Heat carried out of furnace by	viii	123
Blast Furnaces: *see also* Smelters		
Briquetted iron ore for	vi	20
Canada Iron Furnace Co.	iii	120
Canadian returns (1898)	ii	60
(1899)	iii	120
Charcoal consumption per ton of pig iron	ii	46
	ii	219
compared with coke	ii	47
Coke charge per ton of pig iron	vi	8
CRAIG, paper by, on	vi	288–300
Deseronto, Ont.	ii	59
	iv	267, 302
Development of	viii	154
Dominion Iron and Steel Co.	iii	120
Effect of excess of zinc on	viii	119
Ferrona	iv	35
Fuel for	ix	328
Hamilton, Ont.	ii	60
	iv	266, 302
Hot blast stoves, introduction	v	221
Hull	ii	52
Midland, Ont.	iv	267, 302
Moisie, Que.	iv	91
New Glasgow, N. S.	ii	60
Normandale, Ont.	iv	265
Nova Scotia Steel Co.	iv	35
Ontario, notes by CARTER	vii	155
Phosphorus, elimination of in iron for	ii	218
Port Arthur, Ont., bonus for	ix	299
Products, marketing of	ii	227
Radnor Forges, Que.	ii	62
Sault Ste. Marie, Ont.	iii	194
Sweden (1897)	ii	41
Ag	ii	44
DRUMMOND, J. J., notes by	ii	222
Economy of work	ii	216, 217
Kopparberg	ii	42
charcoal consumption	ii	45
Korsa	ii	44
SJOSTEDT, notes by	ii	218, 219
Svartnäs	ii	43
Types	ii	222
Sydney, C. B.	x	373
United States (1899)	iii	118
BIRKINBINE, notes by, on	v	219
number of, in (1837)	ii	224

* See Summaries, page 41
† " " 34

	Vol.	Page
Blast Furnaces—Con.		
Uses of chemical analysis in	x	442
finely divided ore in	vi	20
Blasting: *see also* Explosives, Coal Mines, etc.		
Asbestos	v	337
Bankhead coal mine, Alta	viii	217
Black powder in gassy coal mines	vi	450
BLAKEMORE, paper by, on	i	3–14
Centre Star mine, Rossland, B. C	v	459
Coal Creek colliery, B. C	iv	160
Le Roi mine, Rossland, B. C	v	315, 416
Minnesota iron mines	vii	362
Mother Lode mine, Boundary Dist., B. C., methods of	ix	342
PARLEE, paper by, on	vi	376
Regent iron mines, Mich., methods	vii	323
Simplon tunnel, Switzerland	ii	140
Substitutes for	i	4
Susquehanna Coal Co., Pa	ix	382
Blasting powder: *see also* Explosives		
Coal Creek Colliery, allowance to miners	iv	172
cost	iv	172
Bleaching Powder:		
Manufacture, notes on, by GIBSON	vii	428
Blezard Tp., SUDBURY DIST., ONT.		
Nickel in	iii	225
	vii	497, 499
Blister Copper:		
Electrolytic production	v	193
Blow (?):		
on the relation of dykes to ore bodies, Leadville	ii	86
Blowing engines:		
Converter plant, Copper Cliff, Ont	v	549
BLUE, ARCHIBALD		
****Are There Diamonds in Ontario?***	iii	149–160
Discussion by, on Natural Gas in Ontario	iii	207
Ontario Corundum Deposits	iii	202
Elected Councillor (C.M.I.) 1898	i	18
Notes by		
on export duty on nickel matte	iii	242–246
on iron ore deposits of Northern Ontario	iii	192
Ontario nickel industry, report on	iii	229
Blue, John		
Discussion by, on:		
The Bed-Rock of the Gilbert River Gold-Fields	viii	263, 265, 266
A Note on Varieties of Serpentine in South-eastern Quebec	viii	270, 271
Elected Councillor (1904)	vii	22
(1906)	ix	27
Vice-President (1898)	i	17
Min. Ref.	viii	260
Blue Nose Gold Mining Co.	iv	311
Bluebell mineral claim, BOUNDARY DIST., B.C.		
Bismuthinite	v	369
Bluebell silver-lead mine, AINSWORTH, B.C.	vi	151
Bluestone copper mine, YERINGTON, NEV.	x	258

* See Summaries, page 23

	Vol.	Page
Blum, Anthony		
Discussion by, on		
Suggested improvements to the Mining Laws in Canada	VII	475
Boa Kaine mine, KANALA, NEW CALEDONIA:		
Noumeaite (analysis)	IX	307
Bodenmais: *see under* Germany		
Body's electrolytic refining process:		
Description	V	196
Boerth gold mine, CLARENDON TP., PETERBOROUGH CO., ONT.	VII	210
Ore occurrence at	VII	240
Bog iron ore: *see also* Iron		
Norfolk Co., Ontario	IV	265
Quebec production (1898)	II	65
(1900)	V	350
Radnor Forges, Que.	II	62
St. Maurice River, Que.	II	48
Boiler(s):		
Babcock & Wilcox	IX	376, 408
Covering, mica for	VII	163, 302
Heating feed water for. Paper by HARDIE	VII	505–530
Heine type	IV	172
Hot water feed	IX	207
Jeffrey	IV	167
Lancashire	IX	408
Polson	IV	167, 172
Selection of, for collieries	IX	207
Boiler plant:		
Coal Creek colliery	IV	172
Installation of	V	342
Le Roi mine, Rossland, B.C.	V	204, 326
	VI	182
Mother Lode mine, Greenwood	V	326
	VI	182
Susquehana Coal Co., Pa.	IX	376
Boiler plates:		
Welding	VIII	296
Boiler scale		
Notes by HARDIE	VII	505, 507
Boiler tubes		
Corrosion, test on	VIII	48
Boisdale Hills, CAPE BRETON		
Geology of, paper by BORIGHT	VI	411–434
Bolivia:		
Silver mining, notes by MILLER	VI	34
Bonanza Creek, KLONDYKE, Y. T.		
Gold discovery	V	598
mining	V	575
References	III	124-210-12
Bonanza mineral Claim, BRIDGE RIVER DISTRICT, B.C.		
Gold occurrence	III	21, 29
Bondholder mine, SLOCAN DIST., B. C.	V	11
Veins	V	12
Bonn: *see under* Universities *under* Germany		
Bonney, Prof.:		
On the genesis of diamonds in South Africa	III	157

	Vol.	Page
Bonnington Falls, KOOTENAY RIVER, B.C.		
Electric plant at	IX	351
Water power	VI	180
Booth, George	VIII	17
Boot Jack Lake, QUESNELLE DIV., CARIBOO DIST., B.C.	X	420
Boracic acid:		
Note by MILLER	VI	42
Bordeau, J.		
Discovery of Rossland, B.C. by	V	447
Borea Grit:		
Ohio, U.S.A.	VI	116
BORIGHT, SHERMAN H.		
**Notes on the Geology of the Northern Portion of the Boisdale Hills' Anticline*	VI	411–434
Boring: *see also* Drilling		
for Coal, Belle Plain, near Regina, Sask.	VIII	241
near Carlton, Saskatchewan River, Sask.	X	233
oil, Brantford, Ont.	VII	427
Natural gas, Ontario	III	70–77
Water, Montreal Island	VIII	76
Lake of the Woods, Ont., cost	II	238
Montreal Island, list of	VIII	87 (opp.)
Records of, for geological purposes	II	209
Borneo:		
Platinum	VI	37
Bornite: *see also* Copper		
BREWER, paper by, on B.C. and Yukon occurrences	VIII	172–180
Chibougamau Dist., Que.	VIII	363
	IX	221
Copper Mt., Similkameen Dist., B.C.	V	498
Marble Bay mine, Texada Island, B.C.	X	247
Pacific Coast occurrences	IX	39, 40
	X	195
Sydney Inlet, V.I., B.C.	VI	198
Telkwa River, B. C.	X	222
West Kootenay, B. C.	II	76
Yerington, Nev.	X	259
†***BORNITE ORES OF BRITISH COLUMBIA AND THE YUKON TERRITORY.*** BREWER	VIII	172–180
Discussion on, by COSTE, DRESSER, GOODWIN, GWILLIM.	VIII	181–182
Borron, E. B.		
Manager, Bruce Mines	X	150
Min. Ref.	X	149
Boryslaw, GALICIA, AUSTRIA		
Ozocerite	VI	108
Bosun Mine, NEW DENVER, SLOCAN, B. C.		
Value of zinc ore shipments	III	19
Bothwell Co., ONT.		
Drilling for petroleum	II	189
Boularderie Hills, BOISDALE HILLS, C. B.	VI	411
Boulder Clay: *see also* Clay		
Atlin Dist., B. C.	V	22
Regina Sask., (near)	VIII	242

* See Summaries, page 73
† " " 99

	Vol.	Page
Boulder Creek, ATLIN DIST., B. C.		
Gold production (1900-1901)	v	32
GWILLIM, notes on, by	v	26 et seq
Boulders:		
Atlin Dist., B. C., size of	III	205
Klondike, Y. T., quartz drift	III	125
Bouloupari, NEW CALEDONIA		
Nickel deposit	VI	175
Boundary Creek District: *see* Boundary District, B.C.		
Boundary District, B. C.		
BROCK, paper by, on ore deposits	v	365–378
Conditions (1899)	III	185
Diamond drilling in	IX	317–320
KEFFER, paper by, on Emma mine	X	188–194
on mining in	v	213–217
on mining and smelting	VII	42–45
LEDOUX, paper by, on production of copper in	v	171–177
Ores:		
Analyses	v	516
Character and grade	v	173 et seq
Deposits of, notes by BROCK	VII	60
	X	177
CORLESS	v	514
Values in	VI	228
Boundary Siding, MEGANTIC, QUE.	VII	398
Bounties:		
Government, notes by MEISSNER	v	125
Iron, amount paid (1900)	IV	312
(1901)	v	567, 568
COSTE, notes by	IX	16
Lead, amount paid (1900)	IV	313
Lead, effect in British Columbia	VII	373
Metallic products, LEDOUX, views on	IV	189
Pig iron	IX	25
from foreign ores	II	194
SJOSTEDT, views	v	140, 142
Steel, amount paid (1900)	IV	313
(1901)	v	567, 568
Bourgeois, J.:		
Locator of Le Roi mine	v	447
Bournonite:		
Platinum, occurring with	VIII	198
Bow River, ALTA.		
Coal seams	X	231, 237
Cretaceous plateau, sketch of by DOWLING	VIII	228
Bow River Valley, BANFF DIV., ALTA.		
Coal measures	VIII	221–234
Bowen iron mine:		
Ore analysis	IX	133
Boyd Creek, LARDEAU DIST., B. C.	VII	93
Boyer Lake, MICHIPICOTEN, ONT., *see also* Helen Iron Mine	III	121
Pyrite at	X	121
Boyle, John P.	IX	57
BRADEN, WM.		
***Certain Conditions in Veins and Faults in Butte, Montana**	v	296–308

* See Summaries, page 50

	Vol.	Page
Brainerd, Dwight:		
Discussion by, on The Artesian and other Deep Wells on the Island of Montreal	VIII	97
Swedish Iron Metallurgy and its Application to Canada	II	223
Brake:		
Hoisting	VI	303
Branford, V. V.		
Rep. by on Philadelphia Commercial Museum	VI	319
Brant Co., ONT.		
Petroleum in	VII	175
Brantford, ONT.		
Natural gas	VII	427
Bras D'Or Lakes:		
Excursion of Institute to	IV	33
Bray's Shaft, BRUCE MINES, ONT.	X	155, 159
Brazeau River, BIGHORN RANGE, ALTA.		
Coal on	X	231, 232
Brazil:		
Diamonds	III	155
Gold production 1801-1900	VI	24
Mica	VII	284
Platinum	VIII	198
Brazing:		
Advantages of water gas for	VIII	297
Breccia-conglomerate:		
Greenwater Lake, Ont.	V	53
Breen, James		
Northport Smelter, operation	V	311
sale of interest	V	323
Breeze; *see* Coal-slack		
BRENNAN, C. V.:		
**The Oldham Sterling Gold Mine, Nova Scotia*	X	426–441
BRENT, CHARLES		
†*Algoma Mining Freaks*	IV	174–179
‡*Notes on the Gold Ores of Western Ontario*	VI	327–335
‖*Notes on Oil Furnaces for Assaying and Melting*	V	288–295
BREWER, WM. M.		
°*Bornite Ores of British Columbia and the Yukon Territory*	VIII	172–182
***Further Observations Relative to the Occurrence of Deposits of Copper Ore on the North Pacific Coast and Adjacent Islands, from the Southern Boundary of British Columbia to the Alaskan Peninsula*	X	195–208
††*Mineral Resources of Vancouver Island*	VI	188–199
‡‡*Some Observations Relative to the Occurrence of Deposits of Copper Ore on Vancouver Island and other portions of the Pacific Coast*	IX	39–48
Paper by, on Whitehorse copper deposits, referred to	X	215
Min. Ref.	VI	440
	X	242

* See Summaries, page 148
† " " 30
‡ " " 60
‖ " " 50
° See Summaries, page 99
** " " 137
†† " " 65
‡‡ " " 109

	Vol.	Page
Brick(s):		
Canadian production (1901)	v	572
Lac du Bonnet, Man., manufacture	v	579
Mine-bulkhead construction	vii	86
Ontario production (1893-1903)	vii	392
(1900)	iv	304
(1902)	vi	464, 465
(1903)	vii	428–430
Quebec (1898)	ii	65
Tests of	vii	83
Bridge River Dist., B. C.		
Access to	iii	22
Ben D'Or mine	ii	36
Geology	iii	24
Map	iii	22
Roads	iii	28
Situation	iii	22
Topography	iii	22
***BRIDGE RIVER GOLD MINING CAMP.** CIRKEL	iii	21–29
Bridge(s)		
Cement for building	vii	434
Bridgeville, PICTOU CO., N. S.		
Ferro-manganese, manufacture at	iii	188
Iron ore	v	584
Brigstocke, R. W.	x	19, 20
Briquette(s):		
Grondal Process	x	269
Briquetting:		
Coal, notes by MILLER	vi	33
slack	ix	326
Cobalt ores	x	75
Grondal process	x	267
cost of	x	271
Iron, notes by SNYDER	vii	273
ore	v	58
	vi	19
Peat	vii	393
Bristol iron mines, PONTIAC CO, QUE.	iv	305
Britannia copper mines, HOWE SOUND, B. C.		
Ore deposit at	ix	44
Quartz at	x	208
British Aluminium Company, FOYERS, SCOTLAND:		
Plant	iii	157
British America Corporation:		
Development by, on Pueblo claim	x	198
Purchase Le Roi mine	v	312
"B.C." copper mine, EHOLT, BOUNDARY DIST., B. C.	v	175
Gold values	v	373
British Columbia:		
Bornite ores of, paper by BREWER	viii	172–180
Coal, geology of eastern measures	vii	422
production (1900)	v	564
(1902)	vi	445
supply, paper by BLAKEMORE	vi	224–232
Coke production (1900)	v	565
supply	vi	224–232
Copper production (1901)	v	568

* See Summaries, page 16

	Vol.	Page
British Columbia—Con.		
Excursion of Institute to (1899)	III	179
Free milling gold veins	II	143
Gold dredging	V	87 et seq
production (1901)	V	568
Government		
Revenue and expenditure	VI	361
Subsidy to Crow's Nest Pass Coal Co.	IV	237
Institute Branch, organized in	VI	439
Iron industry, notes by BLAKEMORE	V	79
HOBART	VI	316
Lead production (1901)	V	569
Mica	VII	303
Mineral production (1869–71)	IX	95
(1899)	III	182
(1900)	IV	293
	V	564
(1901), notes by Robertson	V	572–574
(1902)	VI	453
(1906)		
JACOBS, paper by, on	X	183
Progress in	X	186
Mining industry, paper by KIRBY	VI	363–371
laws, notes by COSTE	VII	452–458
THOMPSON	VII	466
MACDONALD	VI	347
companies, overcapitalization of	VIII	243
industry (1899) review of	III	183–187
taxation of	V	320
Molybdenite occurrences	VI	49
	VII	165
Platinum occurrences	VIII	199
Population (1901)	VI	360, 363
Silver production (1901)	V	569
Technical education in, plea for	V	320
Ventilation in coal mines, legal requirements	IV	164
Zinc industry, paper by GARDE	VII	368–376
***BRITISH COLUMBIA COPPER COMPANY'S MINE & SMELTER.** WICKWARE	IX	333-374
British Columbia Smelting & Refining Co.		
Bounty on lead (1900)	IV	313
British East India.		
Copper production (1898-1900)	VI	31
Gold (1885-1900)	VI	25
Mica occurrences	VII	286
British North America Act.		
Education	V	145
British North American Company.		
Copper mining of at Lake Superior	X	400
Bristol, Connecticut	X	252
Bristol iron mine.		
Water power near	X	111
Broad Cove, N.S.		
Colliery	IV	310

* See Summaries, page 125

	Vol.	Page
BROCK, R. W.		
Discussion by, on		
The Geological Survey of Canada as an Educational Institution	VII	444
Mining and Smelting in the Boundary District, B.C.	VI	45
The Nickel Deposits of New Caledonia	VI	485
The Ore Deposits of the Cobalt District, Ont.	X	59
The Ore Deposits of Rossland District, B.C.	VII	59, 60, 62
Elected Councillor (1907)	X	17
Notes on dykes, S.E. British Columbia	V	508
Papers by, on		
**The Geology and Ore Deposits of Franklin Camp, B.C.*	X	170
†*The Ore Deposits of the Boundary (Creek) District, B.C.*	V	365, 378
‡*Poplar Creek and other Camps of the Lardeau District, B.C.*	VII	87, 111
‖*West Kootenay Notes*	III	141–144
°*West Kootenay Ore Bodies*	II	72–86
Quoted on ore deposits, Boundary District.	IX	334–5–6
Min. refs.	VII	444
	IX	17
	X	20
Broken Hill, NEW SOUTH WALES		
Lead Mines:		
Tailing at	VIII	161
Zinc in ores	VII	374
Platinum occurrence near	VIII	197
Smelting problems at	VII	275
Ref. to	VI	34
Bromine:		
Note by MILLER	VI	42
Bromo-Cyanide process: *see also* Cyanidation		
Chemical consumptions in, per ton of concentrate	IV	151
Deloro, Ont., mispickel ores, treated by	IV	118, 122
Description	IV	143 et seq
Gold held in solution	IV	147
Leaching, time required for	IV	147
Percentage of, recovery by	IV	151
Solution, equation	IV	143
Brookfield and Corbett	IX	33
Brookfield gold mine, N. S.		
Chlorination at, paper by FORBES	VII	308–318
Brookfield Mining Company, N. S.	IV	311
Brooklyn copper mine, BOUNDARY DIST., B. C.		
Gold values	V	373
LEDOUX, notes by	V	172
Ore deposit	V	368
Broughton, QUE.		
Asbestos, analysis	V	346
mines, notes by MOLLMAN	V	355
Graphite	IV	303
	X	92
Serpentine	VIII	269

* See Summaries, page 135
† " " 53
‡ " " 76
‖ See Summaries, page 23
° " " 7

	Vol.	Page
Brown, J. Stevenson: *see also* Treasurer, *under* C.M.I.		
Discussion by, on		
The Geological Survey of Canada as an Educational Institution	VII	443
The Mineral Production of Ontario in 1903	VII	431
Elected Treasurer of Institute (1900-1)	III	217
(1902)	V	604
(1904)	VII	22
(1905)	VIII	34
(1906)	IX	27
(1907)	X	17
Report as Treasurer of Institute (1901)	IV	69–70
	V	560
(1902)	VI	(XIV)
(1902–3)	VI	443
(1903)	VII	7
(1904-5)	VIII	7
(1906)	X	9
Tribute by to work of T. STERRY HUNT	VII	409
Views on reprinting Institute's publications	VIII	20
Min. refs	VI	480
	VII	10, 13, 444
	VIII	10, 11
	IX	27
	X	5
Brown, R. H.		
On Establishment of General Mining Association, N.S.	IV	23
Brown, W. G.	X	130
Brown copper claim, KARTAR BAY, ALASKA	X	204
BROWNE, DAVID H.		
Elected Councillor (1907)	X	17
Paper by, on nickel copper mattes, ref. to	X	315
****Use of Graphic Formulae in Metallurgical Calculations***	X	281–300
Min. ref	VII	67
Bruce Copper Mines of Ontario, Ltd., BRUCE MINES, ONT.	IV	301
CARTER, notes by, on	VII	143
Copper production of	X	153, 154
Gold in ores of	VIII	266
Veins, notes by MILLS	VII	183
†***BRUCE MINES, ONTARIO, 1846-1906, THE.*** WILLIAMS, H. J. C.	X	149–161
Discussion on, by BELL, CIRKEL, MILLS	X	167–169
Brule Lake, THUNDER BAY DIST., ONT.		
Iron pyrites at	VII	158
BRUMELL, H. P. H.		
‡***Canadian Graphite***	X	85–104
Min. ref	IX	238
Brumell graphite concentrator	X	93
Brunner-Mond nickel works		
Refining	V	206
Brunswick Dist., ARKANSAS, U.S.A.		
Bituminous rocks	VI	105

* See Summaries, page 145
† " " 134
‡ " " 130

	Vol.	Page
Bryncoch, S. WALES		
Colliery explosion caused by Davy lamps	V	382
Buchanan separator:		
Notes on, by WELLS	IV	16
Bucke, M. A.		
Death	III	179
Buckets:		
Dredge	VI	216
Buckhorn, INDIAN TERRITORY, U.S.A.	VI	105
Buckingham, LABELLE CO., QUE.		
Graphite at	X	89, 91
Buckingham Tp., LABELLE COUNTY, QUE.		
Graphite	VI	76
analysis	X	94, 95
industry (1898)	II	64
Mica	IV	305
Mining in	VIII	35
Phosphorus manufacture in	III	139
Buckingham Graphite Company		
Mill of	X	93
Property	X	91
Budden, H. A.		
Death	III	182
Building Stone(s):		
Canadian production (1901)	V	572
(1902)	VI	454
Ontario production (1900)	IV	304
(1902)	VI	464, 465
(1893–1903)	VII	392
(1903)	VII	428, 430
Ontario resources, notes by MILLER	VII	389
Bulkheads:		
Notes by THOMPSON, on construction of	VII	82–86
Bulkley Valley, SKEENA RIVER DIV., B.C.		
Coal analysis	X	224
discovery	X	223
outcrops	X	226
Volcanic rocks in	X	220
Bull, Marcus		
Investigation of charcoals	II	46
Bull Jig:		
Helena Frisco mill, Idaho	IV	258
"Bulldozing":		
Mother Lode Mine, Boundary Dist., B. C.	V	216
Bullion:		
Athabasca mine, Nelson, B. C.	IV	88
Deloro, Ont., melting	IV	150
Melting	IV	89
Republic reduction works, Wash., gold-silver returns	V	285, 286
Ymir, B. C., gold and silver	III	9

	Vol.	Page
Bullion, CARIBOO DIST., B. C.		
Hydraulic mining at	X	418
Bullock, M. C.	IX	388
Bully Boy min. claim, CAMP BAY, RAINY RIVER D., ONT.	VI	331
Bunkerville, NEVADA		
Platinum at	VIII	199
Bureau of Mines: *see also* Department of Mines		
Establishment in Canada, notes by HARDMAN	V	120
in Montreal	VI	482
Burgess Tp., LEEDS AND LANARK CO., ONT.		
Corundum in	VII	412
Mica in	VII	289
Burley shaft, SULTANA MINE, THUNDER BAY, ONT.	II	87
Diagram and plans	II	91–97
Burning Springs, VA., U.S.A.	VI	105
Burnt Hill Brook, MIRAMICHI RIVER, N.B.		
Molybdenite	VI	48
Burra-Burra, Australia:		
Copper	VI	34
Burrows, A. G.	IX	133
Bussy, Charles de	X	153
Butler, Percy		
Awarded President's gold medal, 1898	II	237
Butte, MONTANA, U.S.A.		
Copper deposits	VI	34
ores of	X	252
Diamond drilling in	IX	389
Replacement deposits	II	82
Secondary enrichment in	X	56
Silver displaced by copper in mines of	X	255
Veins and faults, paper by BRADEN	V	296–301
By-Product coke ovens:		
Alabama	IV	26
Everett, Mass.	IV	11
Sydney, C. B.	IV	11
By-Products:		
Cornwall, tin mining	III	18
Byron Creek, BLAIRMORE DIST., ALTA.		
Coal	VII	423

C

Cable:		
Testing	V	37
Cable derrick:		
Asbestos mines	V	354
Cable gold mines, MONTANA, U.S.A.	X	255

	Vol.	Page
Cable-ways:		
Asbestos mines	v	354
Deloro mine, Ont.	iv	114
Eva mine, Fish River, B. C.	vii	96
FOREST, notes on, by	vi	4
Le Roi mine, Rossland, B. C.	v	410, 469
Lidgerwood travelling	iii	35
New Caledonia mines	vi	179
Port Morien, C. B., installation	iv	131
Wabana iron mines, Nfld.	iii	131
	iv	65
Ymir mine, B.C.	iii	8
Cache Creek series:		
Atlin Dist., B. C.	v	22
Boundary Dist., B. C.	v	366
Skeena River	x	219
Cadell, Henry M.		
Report by, on oil-shale, Lothians, Scotland	vi	77, 117
Cadwallader Creek, BRIDGE RIVER, B. C.	iii	27
Geology	iii	25
Gold occurrence	iii	21, 29
Cage:		
Hoisting	vi	303
CAIRNES, D. D.		
**Prospecting in Western Canada*	viii	302–315
†*Recent Developments in Mining in the Southern Yukon*	x	209–217
Caisson:		
British Columbia, gold dredging	v	89
Lake of the Woods, Ont., Burley Shaft	ii	99
Calabogie, RENFREW CO., ONT.		
Graphite	v	246
	x	85
Iron Mine	vii	152
Calamine: *see* Zinc		
Calamites:		
Boisdale Hills, C. B.	vi	428
Calciferous formation:		
Oil and gas in	vi	112
Calcining:		
Furnace:		
Highland Boy, Utah, notes by SORENSEN	vi	306–316
Westman's	ii	50
Gold-arsenic concentrate	iv	122
Iron ore	iv	201, 202
Spain	iv	202
Calcite: (CALC-SPAR)		
Attraction of, for oil	vii	187, 189
Boundary Dist., B. C.	v	369
copper and iron bearing	v	516

* See Summaries, page 106
† " " 138

	Vol.	Page
Calcite (Calc-spar)—Con.		
Copper Mt., Similkameen Dist., B. C.	v	498
Crushing	iv	208
Ferguson, Lardeau Dist., B. C.	vii	98
Hastings formation, Ont.	iv	220
Marble Bay mine, Texada Island, B. C.	x	247, 248
Whitewater mine, B. C., silver in	iii	171
"Calcite Ores"		
Boundary Dist., B. C., analyses	v	516
Calcium Carbide:		
Manufacture: in Canada	ii	230
Discovered by Willson	ii	227
by Electricity	ii	136
Limestones suitable for	iv	153
Ontario:		
Price	ii	232
Production, (1901)	v	581
(1902)	vi	464, 465
Qualities	ii	228
Statistics (1903)	vii	392, 426, 430
Caldecott process:		
for Treatment of slime	iv	151
Calder Creek, KLONDIKE, Y.T.	iii	124
Caldwell, John F.	ii	87
Caldwell vs. Fraser:		
Decision of Privy Council	ii	242
Caledonia colliery, C. B.		
Air compressor test	ii	130
Blasting experiments at	i	7, 8
Description	iv	29
Caledonia Springs, PRESCOTT CO., ONT.		
Mineral water at	viii	91
Natural gas	iii	68
Calera Rancho, SANTA BARBARA, CAL.		
Natural gas	vi	95
Calgary, ALTA.		
Geology	vii	423
California, U.S.A.		
Companies' Act in	x	335
Copper deposits in Northern	x	255
Gold mining	iv	46, 47
Oilfields, notes by COSTE	vi	95, 107
Platinum	viii	198
Quicksilver	vi	35
Calm Bay mine, SEINE RIVER, ONT.		
Vein at	viii	190
Calm Lake, SEINE RIVER, ONT.		
Formation at	viii	184
Calorific Power (*see also* Coal, Carbon, Combustion, Fuel, Hydrogen, Sulphur)		
Carbon-monoxide	iv	137
Hydro-carbons	iv	137
Lignite	ix	325
Marsh gas	iv	138
MASON, notes by, on	iv	135 et seq

	Vol.	Page
Calorimetric tests:		
Wood-gas	v	181
Calumet, QUE.		
Graphite at	x	89
mill near	x	92
Calumet & British Columbia Gold Mines, Ltd.	vii	95
Calumet classifier:	iv	258
Calumet & Hecla copper mines, MICH.		
Production costs at	x	415
Calumet Island, QUE.		
Galena	ii	63
Calyx drill	v	133
DICK, notes by	ix	387
FORREST, notes by	vi	5
Camborne, LARDEAU DIST., B. C.	vii	87
Camborne School of Mines, CORNWALL:		
Teaching methods at	v	4
Cambrian formation:		
Bilbao Dist., Spain	iv	203
Boisdale Hills, C. B.	vi	414 et seq
Crowsnest Pass, B. C.	iv	231
DuLoup River, Que	viii	263
Easterm Townships, auriferous	ii	119
Newfoundland, petroleum	iii	82
Nova Scotia gold measures	ii	119
Rocky Mts.	viii	223
Thunder Bay Dist., Ont.	vii	140
West Kootenay, B. C.	v	506
Nisconlith, series of	ii	73
Western Ontario, classification	v	50
iron ore deposits	v	511 et seq
Cameron Island min. claim, RAINY RIVER DIST., ONT.	vi	332
Camp McKinney, B. C.		
Mineralization	ii	144
CAMPBELL, C. M.		
****Mining in the Rossland District***	v	447–483
Campbell, C. St. G.	x	73
Campbell, Geo.:		
Views on a Canadian Dept. of Mines	v	595
Campbell, H. H.		
Quoted on manufacture of iron and steel	x	393, 395
Campbell, P. C.	vii	498
CAMPBELL, DR. WILLIAM		
†***The Microstructure of Nickeliferous Pyrrhotites***	x	274–280
Min. ref.	x	17
CAMPBELL-JOHNSTON, R. C.		
Discussion on The Small Economies of Mining	iii	170
Paper by, on		
‡***The Dry Ores of the Slocan***	v	10–14
Campbell furnace:	viii	148
	x	377
Canada:		
Agricultural exports of, 1896-1904	ix	105
Asbestos production, 1879-1901	v	350
notes by JOHNSON	vi	71
paper by MOLLMAN	v	343–357

* See Summaries, page 56
† " " 144
‡ " " 37

	Vol.	Page
Canada—Con.		
Chromite	II	25
Coal production, 1850-1900	VI	31
1902	VI	445
trade, 1902	VI	446
Cordilleran system, mineral wealth of	VII	468
Erian flora of	II	187
Gold production, 1885-1900	VI	25
Graphite statistics	X	99
Iron industry, 1898	II	57, 59
1899	II	38
	III	120–123
opportunities for establishing in	II	48
ore exports, 1900	V	566
and steel exports, 1903-1904	VIII	132
production, pig, 1900	VI	6
Joint stock companies	IV	79
Mica industry	V	243–245
occurrences	VII	286, 289
Mineral production, 1871-1904	IX	104
1898	II	212
1900	V	564
1900, report by BELL	IV	292 et seq
1902	VI	453 et seq
1906	X	12
compared with United States, paper by JOHNSON	VI	66–72
Mining in, paper by HOBART	VI	313–316
industry, 1900, review by BELL	V	563 et seq
laws of, paper by COSTE	VII	450–466
Nickel production	VI	69
1889-1897	III	234, 235
Quicksilver, occurrence in	II	13
Water powers	III	138, 139
Canada Coal & Railway Co.:		
Production (1901)	V	583
Canada Corundum Co., CRAIGMONT, ONT.		
Mining and concentration	V	164
notes by CARTER on	VII	159
Organization	VII	414
Product	IV	183
Min. ref.	VII	426, 432
Canada Iron Furnace Co., Ltd., MONTREAL, QUE.		
Bounties on pig iron, production of, 1900	IV	312
Iron ore imports, 1900	V	566
MIDLAND, ONT Laboratory, description by CRAIG	VI	296
Plant and practice	X	442
Statistics, 1898	II	59, 61
1899	III	120 et seq
1900	IV	302–305
	V	565
Canada Mining & Metallurgical Co., MASSEY, ONT.	IV	301
Canada Petroleum Co.		
Liquidation of	IV	309
Canadian-American Coal & Coke Co., FRANK, ALTA.	V	107, 108
Operations, notes by SMITH (F. B.)	V	110

	Vol.	Page
Canadian Copper Co., COPPER CLIFF, ONT.		
BELL, notes on, by	IV	300
Conditions, 1903	VII	425
Converters	V	549
Copper Cliff mine	V	533 et seq
Early operations of, notes by EVANS	VII	497
Exhibit at Buffalo	V	252
Formation of	VII	496
Incorporation	III	243
Metallurgical practice	V	544 et seq
Nickel mines of	VII	148
refining	V	206, 397
Precious metals in matte	VIII	212
Smelting works	III	224
first built by	VII	498
Canadian Copper Co., CLEVELAND, OHIO:		
Refining plant	V	399
Canadian Corundum Co.		
Exhibit Buffalo Exposition	V	253
***CANADIAN DELLWIK-FLEISCHER WATER GAS PLANT,** SJOSTEDT	VIII	290–301
Canadian Department of Mines (*see* Department of Mines)		
†***CANADIAN DEPARTMENT OF MINES OR GEOLOGICAL SURVEY,** TYRRELL	IX	107–111
Discussion by HARDMAN, INGALL, MILLER, LOW	IX	111–112
Canadian Geological Survey (*see also* Geological Survey)		
Acts respecting	IX	90, 95, 98
Archean formation, nomenclature	VI	257
BLAKEMORE, views on	V	590
Compilation of mineral statistics by	VI	456
DAWSON, report on Crowsnest Pass coal areas, by	IV	230
Economic work of	IX	94 et seq
as an Educational Institution, paper by WALKER	VII	435–438
Efficiency, notes by ADAMS	V	585
Elk River Coal Basin, East Kootenay, report on	IV	233
HARDMAN, notes on,	V	121
History of	IX	87
paper by BELL, ROBT	X	342–370
Mining and statistical branch of	IX	101
statistics compiled by	VIII	162, 168
MCEVOY, notes by	V	149
MEISSNER, notes by	V	127, 153
Molybdenite, report on	VI	48
Nova Scotia, economic work of, in	II	248
Ontario, discovery of corundum in	III	202
PARKS, notes on work of	VII	172
Parliamentary Committee's report on	IX	96
Presentation of Dawson and Selwyn portraits	V	563
Publications, notes by GWILLIM	V	139
Relation to mining industry, notes by COSTE	VII	33
Resolutions of Institute anent	II	253
	III	181
Staff:		
ADAMS, views on	V	587 et seq
Inadequate remuneration	II	249, 253
	IV	71, 72

* See Summaries, page 106
† " " 114

	Vol.	Page
Canadian Geological Survey—Con.		
Staff:		
Restrictions on	IX	109–112
Travelling expenses of	VII	445
Surveying in Unexplored Regions, paper by BELL	VIII	56–8
TYRRELL, paper by, on work of	IX	107–111
Canadian Gold Fields, Ltd.	IV	303
Canadian Government:		
Crowsnest Pass, B. C., coal-lands reserve	IV	229
Subsidy	IV	237
***CANADIAN GRAPHITE.** BRUMELL	X	85–104
Canadian Manufacturers' Association:		
Encouragement of technical education	V	146
Secretary's report, 1904	VIII	16
†***CANADIAN METALLURGICAL PRODUCTS FOR THE FAR EAST.*** HOBART	VIII	158–160
Discussion by COSTE, GARDE, BATEMAN	VIII	160–161
Canadian Mica Miners' Association	IV	77
Canadian Mining Institute		
Affiliation with Quebec Mining Association	I	19
Annual Dinner, 1899	II	258
1906	IX	24
1907	X	16
Auditors, appointment (1901)	V	562
Branches, organization of, in British Columbia	VI	439
resolution respecting	V	604
Constitution and By-Laws, 1898	I	37–41
1900	III	208, 209
Amendments 1900	III	192
1905	VIII	23
1907	X	12, 13
		31–41
Council:		
Meetings, 1899	II	259, 263
Reports, 1898-9	II	197
1902	VI,	IX-XV
1903	VII	3–7
1904-5	VII	22–23
Dissolution of Federated Institute	II	197
Excursions:		
British Columbia, 1899	III	179
Cape Breton, 1900	IV	289
Cobalt, 1907	X	19
Louisburg, C. B.	IV	32
Newfoundland	IV	60–67
Pictou County, N. S.	IV	33–37
Quebec, Que	IV	8
Sherbrooke, Que	IV	4
Sydney, C. B	IV	10
Thetford, Que	IV	7
Financial Statement, 1898	II	201
1900	III	190
Government grants, 1898	II	199
History of, notes by COSTE	VII	26 et seq
Incorporation:		
Charter of	II	199
Motion for	I	18, 22

* See Summaries, page 130
† " " 98

	Vol.	Page
Canadian Mining Institute—Con.		
Library	II	200, 202-4
		253, 260
	III	208
	IV	202
	V	559
	VIII	4
Reports on, 1906	IX	7
1907	X	5
Meetings, British Columbia 1899	II	204
Cape Breton 1900	IV	3–67
Montreal, to complete organization of	I	17, 18
1899	II	195–258
1900	III	175–249
1901	IV	68–80
	V	555–605
1903	VI	442
1905	VIII	1–38
Nelson, B.C. 1899	III	166–174
1902	VI	437
Newfoundland 1900	IV	3–67
Quebec, Que. 1906	IX	1
Rossland, B.C. 1899	III	163–165
Toronto, Ont. 1904	VII	1–25
1907	X	1–20
Membership, 1898–1899	I	42–52
	III	178
1904–5	VIII	3
1906	IX	6
Obituary:		
MacGregor, J.; Nelson, W. J.; Bucke, M. A.; Tuck, T. J.	III	179
Officers 1899	II	252
1900–1	III	217, 218
	IV	77, 78
1901–2	IV	316
	V	604
Patriotic Fund, contribution to	III	190
Patrons	II	252
Publications	II	200
	III	174
	VIII	5
Reports, Annual 1901	IV	69–70
		287–293
of Council 1898–9	II	197
1902	VI	IX, XV
1903	VII	3
Library, 1907	X	5
Resolutions:		
Bell, B. T. A., death of	VII	13
Bounties on pig iron	IX	26
British Columbia eight-hour law	III	172
Canadian Department of Mines	V	589, 594, 597
	IX	21
Geological Survey	II	253
	IV	74

	Vol.	Page
Canadian Mining Institute—Con.		
Canadian Mint, establishment of	II	257
Society of Civil Engineers' Bill	II	255
	V	593
Dawson, G. M.	IV	71
Export duty on nickel matte	III	241
Members serving with colours, South Africa	III	182
Mining legislation	VII	37–41
Ontario mine taxation	X	14
Organization of Branches	V	604
Provincial Mining Bureaus efficiency	II	255
Quebec Bureau of Mines, Montreal office	VI	482
Quebec mining laws	X	20
Yukon gold royalties	III	221
Students, competitions 1904-5	VIII	6
Secretary, *see* Bell, B. T. A., and Lamb, H. Mortimer.		
Canadian Mining Review:		
Publication of Institute papers in	II	259
Canadian Northern Railway:		
British Columbia, fuel supply	VI	227
Thunder Bay District, Ont., construction of	IV	281
Canadian Oil Company	X	81
Canadian Pacific Railway Co.		
Bankhead, Alta., coal mine at	VIII	215
Cascade Coal Basin, Alta., prospecting by	VIII	229
Coal for locomotives, on	V	109
Slocan District, B.C.	VI	147
Sudbury, Ont., nickel discovery due to	VII	495
Trail, B.C., returns 1899	III	186
Canadian Plumbago Company (*see* Montreal Plumbago Co.)		
Canadian Smelting Works:		
Bounty on lead 1900	IV	313
Canadian Society of Civil Engineers:		
Bill respecting engineers, defeat of, in Ontario	II	259
Discussion by Institute	V	560 et seq
Resolution of "	II	257
	V	593
Quebec Act	IV	73
Canal:		
To divert Des Plaines river, Chicago	III	32
Cananea, Mexico:		
Copper deposits	X	177
Canmore, Alta.		
Coal and Coal Mining at:		
Analysis	VII	424
	VIII	237, 238
Coal-bearing measures, flexures in	VIII	227
Coking	IX	327
Description and method of working	V	109
Geology	VII	422
Hardness of coal	VIII	232
Production 1900	IV	298
1901	V	578
1902	VI	454
Seams	V	109
	VI	225, 373
	VIII	231
	X	232

	Vol.	Page
Cantabrian Mts.: *see under* Spain.		
Cantilever:		
Brown type	III	35
Cantley, Thos.		
Elected Councillor 1906	IX	27
Vice-President of Institute 1905	VIII	34
Canyon Creek, Klondike	III	124
Cap Rouge, Inverness County, N.S.		
Barytes	IV	312
Cap Rouge, Ont.		
Anthraxolite	VII	253
Cape Breton Island, N.S.		
Coal analysis	VIII	257
Coal production 1902	VI	445
Collieries	IV	27–30
Early coal mining in	IV	21–22
Iron	II	69
Meeting of Institute	IV	3–67
Molybdenite	VI	48
Steel works	IV	10-13, 34, 35
Cape Breton Coal Co.		
Production 1901	V	583
Cape D'Or, Cumberland Co., N.S.		
Native copper	V	584
Cape John formation:		
Pictou County, N.S. classed as Permian	V	361
Cape Jones, Labrador:		
Animikie formation at	IX	127
Capell ventilating fan	V	109
Capelton, Que.:		
Copper mines	V	82
Early copper mining at	VII	400
Formation at	VIII	260
Pyrites	III	187
	VI	391
Capelton copper mine, Capelton, Que.		
Gold in ores of	VIII	262, 264, 265
Carbide of Calcium, *see* Calcium Carbide.		
Carbon:		
Associated with sulphur in igneous deposits	VI	76
Balfour, Ont., anthracitic	III	160
Calorific power	IV	135, 137
in Coals, Rocky Mts.	VII	501
Coste, note on	VI	74
Drilling with, wear of	V	455
in Keewatin slate	III	159
in Meteorites	III	207
Products of, at high temperatures	III	207
Steel manufacturing, removal of	X	394
Tests for, in pig iron	VI	293
in Volcanic rocks	III	197
Carbonaceous Slates: *see under* Slates		
Carbonates:		
Lardeau district, B.C.	VII	90
Ymir mine, B.C.	III	169
Carbonates mineral claim, Boundary District, B.C.	V	367

	Vol.	Page
"Carbonato":		
Siderite, Bilbao, Spain	IV	200
Carbonic Acid:		
Gas, danger of, from leaking stove-pipes	IV	142
Lava	VI	82
Carboniferous:		
"Albertite" Dist., N.B.	VI	105
Boisdale Hills, C.B.	VI	414 et seq
Cascade Coal Basin	VIII	233
Elk River, East Kootenay, B.C.	V	507
Graphite in	X	89
Joggins, Bay of Fundy, N.S.	VI	447
Nanticoke, Pa	IX	375
Oil and gas, horizons in	III	81
Pictou Co., N.S.	V	358
West Virginia oil fields	III	81
Carborundum		
Furnace lining with	IX	131
Manufacture of	VII	420
Uses	III	201
Cardiff, Col.		
Coke analysis	IV	235
Cardiff Tp., HALIBURTON CO., ONT.		
Radio-active minerals in	VII	255
Cardston, ST. MARY RIVER, B.C.		
Coal analysis and seams	IV	234
***CARIBOO CONSOLIDATED HYDRAULIC PLANT BULLION, B.C., THE,** DICK	X	418–425
Cariboo Creek, LARDEAU DIST., B.C.		
Formation at	VII	92
Cariboo Crossing, Y. T.	X	210, 211
Cariboo Dist., B.C.		
Gold Mining 1900	IV	294
Lead and copper ores	VI	325
Placer gold production from	X	184
ROBERTSON, notes by	V	573
Cariboo mine, CAMP MCKINNEY, B.C.		
Loss in tailing	II	144
Mineralization	II	144
Value of ore	II	144
Carillon, Jerome	VIII	259
Carleton Co., ONT.		
Archean rocks	VII	289
Carlisle copper claim, WHITEHORSE, Y. T.	X	197
Notes by CAIRNES	X	216
Carll, John F.		
Views on the impermeability of strata in oil regions	VI	116
Carlow Tp., HASTINGS CO., ONT.		
Corundum discovery	V	164
occurrences	III	200
	VII	159, 413
Carlton, SASKATCHEWAN RIVER, SASK.		
Boring for coal at	X	233
CARLYLE, E. J.:		
†***The Pioneer Iron Mine, Ely, Minn.***	VII	335–367

* See Summaries, page 148
† " " 84

	Vol.	Page
Carlyle, W. A.		
Appointed manager Le Roi mine	v	312
Boundary dist., B.C., notes by	v	514
Elected vice-president C. M. I., 1898	i	17
Purcell Range, B.C. notes by	v	507
Rossland, B.C. mine development notes by	iii	164
Slocan dist., B.C. classification of veins	v	509
Carmak Spirck Roasting Oven	ii	16
Carmichael, Norman:		
Notes on model of Poorman mine	vi	440
Carnallite:		
Magnesium production from	vi	39
Carpenter Creek, SLOCAN DIST., B.C.	v	11
Carpenter shop:		
Centre Star mine, Rossland, B.C.	v	472
Le Roi mine, Rossland, B.C.	v	337
Carr-Harris R.		
on Canadian Society of Civil Engineers	iv	73
Carter, C.		
Notes by on sulphuric acid mfg	vi	392
CARTER, W. E. H.:		
****The Mines of Ontario***	vii	114–167
Cascade Coal Basin, BANFF DIV., ALTA.		
Stratigraphy of, paper by DOWLING	viii	221–233
Cascade coalfield, ALTA.:		
Coal analysis	vii	424
seams	x	231, 232
Fossils from	viii	233
Cascade Creek, POPLAR CREEK DIST., B.C.	vii	102
Cascade Creek, W. ALTA.:		
Coal analysis	viii	237
Cascade crystalline series:		
Skeena River	x	219
Cascade Mt., ALTA.:		
Anticlinal fold	viii	225, 226
Coal beds	viii	225 et seq
Limestone	viii	229
Cascade River, ALTA:		
Sandstones	viii	229
Shales	viii	229
Cascade River coal mine, ALTA.:		
Coal hardness	x	232
seam	x	232
Cascade Water, Power & Light Co., CASCADE, B.C.	ix	358
Cassiar Coal Co: GOAT CREEK, SKEENA, B.C.	x	224
Coal seams	x	226
Castings:		
Chilled cast iron vs. cast iron for crushers	ii	33
Castle graphite mine, BUCKINGHAM, QUE.	x	90
Cat Mt., BLAIRMORE DIST., ALTA.:		
Coal	vii	423
Caulry, M.:		
Nickel smelting experiments by	vi	178
Caustic soda:		
Manufacture, notes on, by GIBSON	vii	428
Use of, in cleaning copper plates	iv	195

* See Summaries, page 77

	Vol.	Page
CAVERS, T. W.:		
**Treatment of the Dry Ores of the Slocan*	VII	199–201
Cayoosh Creek, BRIDGE RIVER DIST., B.C.		
Gold occurrence	III	29
Placer gold	III	21
Cecil, M.		
Manager, Vancouver Island Development Co.	VIII	174
Cedar:		
for Charcoal	II	47
Celestite:		
Uses and occurrence	VI	44
Cement: *see also* Portland Cement		
Bridge building with	VII	434
Canadian statistics, notes by JOHNSON	VI	70
Industry:		
BROWN, J. S. notes by, on	VI	431
MORRISON, notes by, on	VII	431
in Ontario	V	247
LEONARD, paper by, on	VIII	102
Manufacture of, in Ontario, notes by MILLER	VII	389
Mine bulkheads, notes by THOMPSON	VII	82–86
Production, Manitoba 1901	V	579
Ontario 1893–1903	VII	392
1900	IV	304
1901	V	581
1902	VI	464, 465
1903	VII	430
Quebec 1898	II	65
1900	V	350
Uses	VII	431–432
Cementing:		
Corundum	V	250
Central Oil and Gas Company, TILBURY, ONT.		
Log of	X	82
Oil well of	X	78
Centre Star mine, ROSSLAND, B.C.		
Formation	V	519
Located	V	447
Mineral production 1894-1904	VII	47
Ore deposits at, notes by KIRBY	VII	48 et seq
shipments 1900	V	524
Sale of	VII	478
Shaft	VII	85
sinking and timbering, notes by CAMPBELL	V	455
Surface plant, description	V	472 et seq
Surveying methods in	VIII	317
Veins	V	522
	VIII	317
Centrifugal Pumps:		
Gold dredging	V	93
Cerargyrite:		
Slocan Dist., B.C.	VII	199
†*CERTAIN CONDITIONS IN VEINS AND FAULTS IN BUTTE, MONTANA* BRADEN	V	296–308
Cerium:		
Note by MILLER	VI	43

* See Summaries, page 80
† " " 50

	Vol.	Page
Cerussite:		
Ymir mine, Wild Horse Dist., B.C.	III	7
Ceylon:		
Graphite analysis	X	95
statistics	X	87, 101, 103
Chain haulage plant:		
Alkali mine, Aschersleben	II	185
Chalcocite (COPPER GLANCE)		
Ducktown, Tenn.	X	251
KEMP, notes by, on	X	252
King Solomon mine, Boundary Dist., B.C.	V	375
Little Bronton Lake, Que., (? Brompton)	VIII	271
Telkwa River, B.C.	X	222
West Kootenay, B.C.	II	76
Whitehorse, Y.T.	IX	41
Yerington, Nev.	X	259
Chalcopyrite, *see also* Copper:		
Attraction of for oil	VII	187, 188
Constituents of	X	275
Platinum occurring with	VIII	198, 206, 207
Relation of to pyrrhotite, in nickel deposits	IX	241
Sohland nickel ores	IX	241, 255
Alaska.		
Occurrences	X	199
British Columbia.		
Boundary Dist. King Solomon mine	V	375
Mother Lode mine	V	515
Cherry Bluff, Kamloops Lake	V	371
Copper Mt., Similkameen Dist	V	498
Fish River, Lardeau Dist.	VII	95,97
Franklin Camp	X	173
Pacific Coast occurrences	IX	39
	X	195
Rossland	V	522
	VII	50
origin of	VII	59
Telkwa River	X	222
Vancouver Island,	VI	192
Mt. Sicker	V	229
Sydney Inlet	VI	198
West Kootenay	II	76
Cape Breton.		
Boisdale Hills	VI	414
New Brunswick.		
St. Stephen	IX	238, 239, 240
Ontario.		
Bruce Mines Dist.	VII	144
	X	157
Gladstone Tp. Algoma	VII	180
Sudbury Dist.	V	235
	VII	63, 498
	VIII	203
Copper Cliff mine	V	532

	Vol.	Page
Chalcopyrite—Con.		
Quebec.		
Chibougamau Dist.	VIII	363
	IX	221
Portage Island	X	105
United States.		
Loon Creek Dist, Idaho	IX	55
Yerington, Nev.	X	258
Yukon.		
Conrad	X	211
Windy Arm	IX	51
Challenge roll	II	36
Chamberlin, Thomas C.	X	17
CHAMBERS, R. E.		
Notes on Increased Facilities at Wabana Iron Mine, Nfld.	III	130, 132
Notes on Bell Island iron deposits	II	67
Chaminis Hill, LARDER LAKE, ONT.		
Huronian rocks on	X	69
Chamouchouan Lake, Que.	IX	17
Champion copper mine, MICH.		
Production costs at	X	415
Champion mineral claim, RAT PORTAGE, ONT.	VI	331
Chandler, Prof.:		
Quoted on boiler scale	VII	507
Chandler iron mine, ELY, MINN, U.S.A.		
Deposition at	VII	260
Refer	VII	336
Chandler ventilating fan	IV	239
Channing, R. H.	VI	306
Chapman, Prof. E. J.	IX	91
†***CHARACTERISTICS OF THE ATLIN GOLDFIELD.***		
GWILLIM	V	21–32
Charcoal:		
Blast furnaces:		
in Ontario	X	444
Practice, compared with coke	II	47
in Sweden	II	219
BULL, investigation by	II	46
Bye-Products	II	51
Consumption:		
Blast furnaces:		
Birkinbine, on	II	47
Domnarfvet and Skutskar iron works, Sweden	II	43, 44
Quebec 1900	IV	305
Kopparberg Co. furnaces, Sweden	II	51
per ton of pig iron	II	46
Electric smelting, use of, in	VIII	143
Forests' yields per acre	II	47
FRANCOIS, experiments by	II	46
of Good grade from inferior material	II	47
Kopparberg Co., Sweden production per kiln	II	51
Ljunberg, Sweden, method of charging kiln	II	50–1
Meiller system	II	222
Retorted	II	51
Weights from different woods	II	46

* See Summaries, page 22
† " " 38

	Vol.	Page
Charcoal iron:		
Blast furnace practice	II	51
Corrosion of	VIII	49
Normandale, Ont	IV	265
Ontario, industry	II	59
Production, Quebec, 1898	II	65
1899	III	187
1900	IV	305
United States, 1875-1897	II	52
Radnor Forges, Que	II	61
Charlevoix Co., Que	VII	251
Chateaugay iron mines, NEW YORK, U.S.A.		
Concentration	VI	16
Chatham, Ont.		
Natural gas piped to	X	78
Chats Falls, OTTAWA RIVER, QUE.	X	111
Chaudiere, Que.		
Possibilities of hydraulic mining	IV	9
Chaudiere River, BEAUCE COUNTY, QUE.		
Gold in	VIII	259
Chelsea Falls, GATINEAU RIVER, QUE.	X	111
Chemainus River, VANCOUVER ISLAND, B.C.	VI	195
Schist formation near	IX	47
Chemistry:		
in Canadian universities	V	4
German universities	V	147
Chemical tests:		
of Wire rope	V	38
Chemicals:		
Electrolytic manufacture of	III	134
German production, value	V	147
Chemung formation	II	186, 189, 190
Cherry Bluff, KAMLOOPS LAKE, B.C.		
Ore deposition	V	371
Chert (HORNSTONE)		
Animikie Iron Range	VI	252, 253
Nastapoka Islands, Hudson Bay	V	256
Cheticamp Mining Co	V	584
Cheticamp River, INVERNESS CITY, N.S.		
Gold-silver ores	V	584
Chevandier (?)		
on Charcoal yields per forest acre	II	47
Chibee mica mine, QUE.	VII	285
Chibougamau Dist., QUE.		
Formations in, notes by LOW	IX	19
HARDMAN, lecture on	IX	17
Nickeliferous pyrrhotite in	IX	221
OBALSKI, papers on	VIII	363–366
	IX	218–220,
	X	105
Chicago:		
Area within city limits	III	32
Sanitary district, organization of	III	32
Sewerage system	III	32
***CHICAGO MAIN DRAINAGE CHANNEL, THE.** LEWIS	III	30–36
Excavation	III	33
Operating costs	III	33–36

* See Summaries, page 16

	Vol.	Page
Chili:		
Copper mining	II	108
	VI	34
Chillagoe, Queensland.		
Copper occurrence	X	254
China:		
Artesian wells	VIII	83
Coalfields	VI	32
Gold production 1885–1900	VI	25
Hanyang Steel Works	VI	30
Hong Kong, copper shipments to	VIII	159
Market for Canadian mineral products	VIII	158
China Creek, ALBERNI DIST., V.I., B.C.	VI	189, 197
Chinese:		
Resident in British Columbia 1901	VI	363
"Chirta":		
Iron ore, Bilbao, Spain	IV	200 et seq
Chisholm, A. M.	VI	51
Chloride solutions:		
Hoepfner electrolytic process (diagram)	V	211–212
	V	393 et seq
***CHLORIDIZING TREATMENT OF NICKEL ORES**		
RUTHERFORD	VIII	336–342
Chlorination:		
Discovery	VI	27
Drying gold precipitate	V	291
†***CHLORINATION OF GOLD ORE OF THE NORTH BROOKFIELD MINE, NOVA SCOTIA.*** H. L. FORBES	VII	308–318
Chlorine:		
Methods of generating	III	135
Chlorite:		
Boundary Dist, B.C.	V	369
Chlorite schist:		
Belmont, Peterborough Co., Ont.	VII	222 et seq
Fish River, Lardeau Dist., B.C.	VII	93
Choca, COLUMBIA, SOUTH AMERICA.		
Platinum at	VIII	192
Christie and Palmer	VIII	173
	X	245
Chrome siding	II	26
Chrome steel:		
from Canadian ores	II	26
Chrome and Chromite:		
Assaying	V	45
Canadian production 1901	V	571
1902	VI	454
Coleraine, Que.,	II	25, 26
concentration	II	62
occurrence	II	25
Concentration, special test in, at McGill University	V	7
Crushing	IV	208, 212
Douglas County, Oregon	IV	186
Eastern Tps., Que., paper by EDWARDS on production and uses	IX	35–38
Little Bronton Lake, Que., (? Brompton)	VIII	271
New Caledonia	VI	170, 172, 179

* See Summaries, page 107
† " " 83

	Vol.	Page
Chrome and Chromite—Con.		
Nickel associated with	IV	184
North Carolina, Webster nickel ores	IX	309
Occurrences and use, notes by MILLER	VI	40
Oxide, price	V	7
Platinum associated with	VIII	198, 200
relation to	VIII	202
Quebec industry 1898	II	62
production 1898	II	65
1899	III	187
1900	IV	308
	V	350
Wilfley test on Canadian ores	II	26
Chromium:		
Assaying	V	43
Determination	V	45
Chrysocolla:		
King Solomon mine, Boundary Dist, B.C.	V	375
Yerington, Nev.	X	259
Chrysoprase, *see under* Precious stones.		
Church, J. A.		
Quoted on consumption of charcoal per ton of pig iron	II	46
Chutes:		
Compressed air for opening and closing	V	332, 342
Location of in "Diamond" system of coal mining	IV	129
Cinnabar: *see also* Quicksilver		
Composition	II	13
Criss Creek, B.C.	II	14
Kamloops Lake, B.C. (near)	VIII	181
Savonas, B.C. occurrence	II	13, 14
Vancouver Island, B.C.	V	231
West Kootenay, B.C.	II	76
	III	144
Cinnabar Mining Co.		
Savonas, B.C., operations at	II	14
Cincinnati. OHIO, U.S.A.:		
Discovery of diamonds near	III	153
CIRKEL, FRITZ.		
Discussions by, on:		
The Bruce Mines, Ont.	X	168
A new mining district in Northern Quebec	VIII	366
Papers by on		
**Bridge River Gold Mining Camp, The*	III	21–29
†*Iron Mining Possibilities in Quebec*	X	108–117
‡*Notes on the Milling of Gold in Republic, Wash,*	V	274–287
Ref	VIII	20
	X	19
City of Paris mine, BOUNDARY DIST., B.C.		
Dyke	V	366
Tetrahedrite	V	369
Civil Service Commission:		
Recommendation by, to establish cartographic dept	VI	319
Report of 1882 on creation of cartographic branch	IX	76
Clanny safety lamp	IV	166
	IX	385

* See Summaries, page 16
† " " 131
‡ " " 49

	Vol.	Page
Clanny safety lamp—Con.		
Disadvantages of	VI	201
Fernie, B.C. colliery explosion	V	382
Tests with	V	384 et seq
Clarendon Tp., FRONTENAC COUNTY, ONT.		
Gold occurrences	VII	210
Clark, George	X	151
CLARK, J. M.		
Discussions by, on:		
The Geological Survey as an Educational Institution	VII	447
Natural Gas in Ontario	III	208
Suggested Improvements to the Mining Laws in Canada	VII	469–478
Notes by, on:		
Export duty of nickel	III	226, 227
Issue of shares at discount	IV	79
Ontario mine taxation	X	13
Papers by:		
**Company Law*	IV	244–253
†*Ontario Mining Law, The*	III	110–117
‡*Revision of the Mines Act of Ontario, The*	IX	113–114
‖*Royalties on Minerals in Ontario*	X	340–341
Min. ref	VII	12
	VIII	10
	X	14
Clarke, E. C.		
Experiments of, with concrete	VIII	104, 107
CLARKE, F. SATCHELL		
°*A few notes on gold dredging*	V	87–103
Clarke, Dr. J. M.		
Quoted on age of Ohio shales	II	186
Classification:		
Galena, Cœur d'Alene Dist, Idaho	IV	260 et seq
of Pulp, Deloro Mill, Ont	IV	120
Classifiers:		
Helena Frisco Mill, Idaho, U.S.A	IV	258
Clausthal, Germany.		
Concentration of galena ores	IV	263
Clay:		
Atlin Dist, B.C	V	22
Bilbao Dist., Spain, ferruginous	IV	200–201
Butte, Mont., selvage	V	300
Concrete making with	VIII	107
Goat Creek, Skeena Div., B.C	X	226
Lac du Bonnet, Man.	V	579
Ontario resources, notes by MILLER	VII	388
Clearwater River, THOMPSON RIVER, B.C.		
Gold dredging opportunities	V	96
Clergue, F. H.		
Operations at Sault Ste. Marie, Ont	IV	301, 302
Min. ref	III	121
Clergue Iron Works, SAULT STE. MARIE, ONT.	VI	466

* See Summaries, page 35
† " " 20
‡ " " 115
‖ See Summaries, page 146
° " " 42

	Vol.	Page
Cleveite:		
Murray Bay, Que.	IX	72
Saguenay Dist., Que.	VII	245
Cleveland, U.S.A.		
Nickel refining plant	V	399
Clifton-Morenci Copper Deposits, ARIZONA	X	177
Climate:		
Arctic Canada, Low, views on	VIII	22
Atlin Dist, B.C.	III	101
Oregon, U.S.A.	IV	185
Vancouver Island, B.C.	V	228
Yukon	V	603
Clinton formation:		
Essex Co., Ont., salt water invariably found in	III	75
Lancaster, Ohio.	III	82
Natural gas in	III	78–80
Oil and gas in	VI	112
Shales	II	189
Tilbury oilfields, Ont	X	82
Western Ontario.	II	187, 208 209
Clover Creek quicksilver mine:		
Prospectus of	IX	282
Coal and Coal Mining:		
Alterations of, by pressure and heat	VIII	239, 240
	X	224
Analysing	X	450
Area *see under* Alberta, British Columbia, Nova Scotia, etc.		
Ash, elimination of, by washing	IX	329
Barometric pressure, effect of, in	V	392
Blasting with compressed cartridges	I	3
Blending for coking, etc	IX	327, 328
Character	VIII I	238
Coking, from briquetted	IX	327
Crushing	IV	208, 210, 218
Cutting, labour	IX	201
machines: Fergie's views on	VI	449
Harrison	V	110
Development from lignites to bituminous.	VIII	238
DOWLING, paper by, on inferior and slack	IX	321–327
Alberta, Saskatchewan and Manitoba	X	229–241
Dust:		
Anthracite, method of coking	IX	327
Explosions due to	VI	202, 204
notes by FERGIE	VI	450
HARDIE	VI	202
Explosive qualities, with fire damp	V	380
Hydro-carbons in	VI	202
in Safety lamp, effect on	VI	201, 205, 206
Electric drilling.	II	182
Factors in production of true	VII	423
FERGIE, C., paper by, on Canadian	IV	444–451
Flat seams.	VII	502 et seq
Fuel, compared with gas and coke	IV	135–142

	Vol.	Page
Coal and Coal Mining—Con.:		
Gas, calorific power of	IV	137
for domestic fuel	V	138
in, per pound	VIII	300
mixing with air previous to combustion	IV	139
produced from	IX	325
Genesis of, notes by GWILLIM	VIII	235 et seq
HARDIE, paper by, on management	IX	200–209
Heat-giving properties	IV	135
Importation of, duty free	IX	26
Industry, notes by MILLER on history of in XIX Century	VI	30 et seq
Inferior and slack, notes on utilization of, by DOWLING	IX	321, 327
Kootanie measures, fuel ratios	X	230
hardness of	X	232
percentage of water in	X	231
Laramie-Edmonton, fuel ratios and porosity of	X	236
Locomotive fuel on C. P. Ry	V	109
MASON, paper by, on domestic use of	IV	135–142
Methods:		
"Across the pitch"	II	18
"Across the Pitch versus up the Pitch"	IV	126–130
"Diamond" system	IV	129
Four entry system	V	108
Pillar and stall system	IV	157
Pitching seams	VII	503
"Up the Pitch"	II	18
MILLER, W. G., notes by, on history of	VI	30
Mines: *see also* Collieries.		
Boilers for, notes on, by HARDIE	IX	207
Electricity vs. compressed air in	VI	449
Explosions in, causes	V	379–392
Haulage systems in	IX	206
Marsh-gas in anthracite	VI	203
Safety lamps for	V	379 et seq
Surveying	IX	204
Origin of	VII	423, 500
Physical and chemical properties affected by pressure	VII	503 et seq
Picking	IX	265
Pillars:		
Pillar and stall system	IV	157
Pulling	IV	127
Strength and size of	II	18
Properties, for domestic purposes	IV	136
Prospecting for	VI	1
Screening	IV	166
Seams:		
Effect of pressure on	VII	503 et seq
and heat on	VIII	237
Flat and pitching, methods of mining	VII	502 et seq
Foothills, Rocky Mts. area	X	234
Forming part of, or following lines across measures,	VIII	239
Gobbing	IV	127
GWILLIM, notes on life history of	VIII	235
Igneous intrusion, effect on, of	VIII	240
	X	224
Laramie-formation	X	234
Laramie-Edmonton formation	X	236

Coal and Coal Mining—Con.:	Vol.	Page
Seams—Con.:		
Machine mining of	IX	202
Rocky Mts. eastern slopes of	VI	225
foothills, age of	V	106
Thick and thin, methods of mining	IV	126 et seq
Tilting-up of	VII	503
Vertical	V	110
Series, Rocky Mts.	VII	423
Shaft-lining with cement	VII	434
Slack:		
Briquetting	IX	326
Coking, average charge per oven	IV	169
Furnace fuel	IX	326
Utilization of	IX	321–7
Statistics:		
Canada, 1902	VI	454, 455
JOHNSON, notes by, on	VI	70
Method of compiling	VIII	165
World's production 1900	VI	32
Steam raising power of	VIII	59
Trade, Canada 1902	VI	446
Canadian exports 1900	V	565
Ventilation:		
Fans *see that title.*		
PEACOCK, paper by	IV	107–112
Washing	IX	407
Water-gas from	V	178

Alberta.

Analytical table showing transition	V	106
Anthracite altered by metamorphism	V	110
Available supply	V	112
DOWLING, description of fields by	X	229–241
Geology of Western	VII	422
Industry 1900	IV	298
Statistics 1900	IV	298
1902	VI	445, 453
Trade	IV	298

Anthracite:

McNeil, H. W. & Co's. mines at	IV	298
	V	107
	VI	373
Mining at	VIII	228
methods	II	17
	V	110
Seams	II	17
	VIII	228
Bankhead	VIII	238
	IX	261
character	VIII	215
HENRETTA, paper by	VIII	215–220
Mining methods	VIII	216
Pacific Coal Co.	VIII	215–220
Seams	VIII	215, 231, 241

Coal and Coal Mining—Con.:	Vol.	Page
Alberta—Con.		
Belly River measures, percentage of water in	x	234
series, seams	viii	221
Bighorn, seams	x	231, 232
Blairmore	vi	231, 374
seams	vi	232
	x	230
Canmore	viii	238
McNeil, H. W. & Co	v	107
Mines of	vi	373
Mining methods at	v	109
Seams	v	109
	viii	231
Cascade, stratigraphy of	viii	221–233
River, seams	x	229 et seq
Coleman, seams	x	230
Costigan, seams	x	231, 232
Edmonton, character of coals	vi	374
Coalfields of	vi	374
	vii	422
Measures, percentage of water in	x	234
Frank, Canadian-American Coal & Coke Co.	v	107, 110
Mines at	vi	374
Mining methods	v	110
Seams	v	110, 374
Turtle Mt.	vi	232
Gold Creek, mines of	vi	375
Lethbridge	v	106
	vii	422
Alberta Railway & Coal Co	v	107
thickness of seams	v	108
cutting machines at	v	108
Mines of	vi	373
Seams	viii	238
	x	233, 234
quality of	v	105
Medicine Hat Dist.,	v	106
seams	x	233
structure	v	106
Mill Creek	x	234
Moose Mt.	x	231, 232
Palliser	x	231, 232
Rocky Mts. (Alta. and B.C.)		
Bituminous, occurrence of	viii	239
Coalfields	vii	422
age of	viii	238
Decrease of water	viii	238
Origin of	vii	422
Percentage of fixed carbon	vii	501
Semi-anthracite, occurrence in	viii	239
Assiniboia.		
Production 1902	vi	445
Belgium.		
Mining methods in	iv	128
British Columbia.		
Anthracite occurrences	viii	240
BLAKEMORE, paper by, on future supply of	vi	224–232

Coal and Coal Mining—Con.:	Vol.	Page
British Columbia—Con.:		
Geology of Eastern	VII	422
Statistics 1900–1901	V	572
1902	VI	445, 453
to 1906	X	183
Ventilation, legal requirements for	IV	164
Crowsnest area:		
BLAKEMORE, paper by, on	IV	230–243
Coal Creek, analysis	VIII	237
CORLESS, paper by, on	IV	155–173
Elk River	X	230, 232
McEVOY, notes by on mining in	VII	500–504
Michel	X	230, 232
Morrisey, seams	VI	230
Nicola area	VI	226
Similkameen area	VI	226
Princeton	VI	227
Skeena area:		
CAIRNES, notes by, on	X	223 et seq
Vancouver Island:		
BEST, notes by	V	229
BREWER, notes by	VI	188, 195
Union	VIII	240
Canada.		
Arctic	VIII	22
Consumption 1902	VI	446
Imports from U. S.	VI	450
FERGIE, paper by, on mining in	VI	444–51
Northwest, prices	IV	300
Production 1900	V	564
1902	VI	454, 455
Trade 1902	VI	446
exports 1900	V	565
Western:		
Analysis of	VI	225, 227, 230–232
	VII	424
Compared with U. S. products	IX	323
Geological development	VII	500
GWILLIM, notes by, on	VII	422–4
Horizons	X	229 et seq
Markets for	IV	170
	VI	224 et seq
Great Britain.		
Cumberland, Eng:		
Brayton Domain No. 4 colliery, description of	IX	402–12
Cutting	VI	449
Prices	III	119
Working thick seams	IV	239
Manitoba.		
DOWLING, report on, by	X	229–241
Production 1902	VI	454
Southern, fragments of, in boulder clay	VIII	242
seams in Dakota sandstone	VIII	242
Trade, markets in	IV	299

	Vol.	Page
Coal and Coal Mining—Con.:		
Mexico.		
Santa Clara, Senora	VIII	240
New Brunswick.		
Production 1902	VI	445
Royalty on	VII	458
Newfoundland.		
Character	IV	24
North West Territories.		
Mining regulations 1898	V	111
SMITH, paper on, by	V	104–12
Trade	IV	299
Nova Scotia.		
Cutting machines	VI	449
FERGIE, notes by	VI	446 et seq
Industry 1899	III	188
Royalties on	VII	458
Statistics 1899	III	189
1900	IV	309
1901	V	583
1902	VI	445, 453
Trade 1899	III	188
1900	IV	310
Cape Breton County:		
Dominion Coal Co., history	IV	21–24
operations	IV	15, 29
	VI	446
plant	IV	29, 30
seams	IV	27, 28, 29
	VI	447
Measures	IV	23
Port Morien	IV	131
Slack, analysis	IV	11
Sydney North	IV	61
Cumberland Co.:		
Machine mining	VI	449
Seams	VI	447
Pictou Co.:		
Dust	V	362
Mining	VI	447
Neo-carboniferous	V	358
Production 1900	V	358
Seams	V	362
	VI	447
Stellarton formation	V	359
Ontario.		
Possibility of finding in	VII	174
Russia.		
Southern	IV	25
Saskatchewan.		
Analytical table showing transition	V	106
Cypress Hills, seams	X	235
DOWLING, report by	X	229–241
Roche Percee	VI	374
Seams	V	105
Souris Dist., seams	X	235
	VI	374
River	V	105

Coal and Coal Mining—Con.:	Vol.	Page
United States.		
Cutting	VI	449
Geological Survey tests on	IX	322 et seq
Import duty	VI	451
Alaska:		
Controller's Bay, report by COSTE	VIII	242
Hawaiian Islands:		
Price	VIII	59
Kentucky	VII	500
Pennsylvania:		
Law respecting barrier pillars	IX	381
Nanticoke	IX	375–386
Washington	IV	128, 129
Virginia	VII	500
Yukon.		
Occurrences	III	212
	IV	296–7
Production 1901	V	576
1902	VI	445
Whitehorse	X	216
***COALS AND COALFIELDS OF ALBERTA, SASKATCHEWAN AND MANITOBA,** DOWLING	X	229–237
Coal Creek, E. KOOTENAY, B.C. *see also* Crowsnest Pass *and under* Coal.		
Coal analysis	VII	503
	VIII	237
cutting	IV	238
Colliery, description and methods of mining by CORLESS	IV	155–173
BLAKEMORE, notes by	IV	234 et seq
†***COAL CREEK COLLIERY OF THE CROWSNEST PASS COAL CO.,** CORLESS	IV	155–173
Coal Creek, WEST OF COCHRANE, ALTA.:		
Coal at	X	236
‡***COAL GAS AND COKE AS DOMESTIC FUELS,** F. H. MASON	IV	135–142
¶***COAL MINING IN THE NORTHWEST TERRITORIES AND ITS PROBABLE FUTURE,** SMITH	V	104–112
Coal tar:		
Indigo manufacture	V	145
MILLER, notes by	VI	33
Use in cementing coal dust in manufacture of artificial fuel	IX	323
Coast Range:		
British Columbia:		
Batholith	X	243
Granite	X	49, 50
California:		
Oilfields	VI	95
Coates, G. R.		
Death	II	198

* See Summaries, page 140
† " " 30
‡ See Summaries, page 28
¶ " " 42

	Vol.	Page
Cobalt *see also* Nickel		
Bruce Mines, Ont. (near)	X	169
Chibougamau, Que	IX	221
	X	105
Evje, Norway	VII	405
Haileybury, Ont.	VII	385
New Caledonia	VI	171, 179
nickel ores	IX	309
Nipissing Dist., Ont.	IV	277
Ontario occurrences, notes by MILLER	VII	381, 382
production 1905	IX	14
Quebec, discovery in	II	62
Rossland Dist., B.C.	V	451, 522
	VII	51
Smelting of, paper by HIXON	X	74–76
Skuterud, Norway	VII	406
Sudbury Dist., Ont.	V	534
	VIII	213
Cobalt Dist., Ont.		
BELL, ROBT., paper by, on geology of	X	62–68
Cyanide tests on ores of	IX	396
Discovery of silver ores at	VII	142
	VIII	36
Excursion of Institute to, 1907	X	19
Joint stock companies in	X	331
LEDOUX, paper by, on ores of	X	72
MILLER, notes by 1907	X	16
Silver production from 1905	IX	14
VAN HISE, paper by, on ore deposits of	X	45–53
Cobalt Hill mine, COBALT, ONT.		
Graphite in vein of	X	58
COBALT MINING DISTRICT, THE, BELL	X	62–68
Cobalt-nickel:		
Solubility of, in ammonia	VIII	358–362
Cobaltite:		
Cobalt Dist., origin of	X	46
Cobbing:		
Magnetic	VI	15, 16
Mica	VII	300
Cobbledick dredge	V	91
Cochran Hill, N.S.		
Gold quartz veins	II	248
Cochrane, Hon. Frank	X	2, 14, 16
Cody, B. C	V	11
Cody Creek, SLOCAN DIST., B.C.		
Dry ores of	V	11
Coe Hill, ONT.		
Iron ore	IV	268
Cœur d'Alene Dist., IDAHO, U.S.A.		
Galena concentration in	IV	254 et seq
Silver-lead ores	VI	151
Cohen (?)		
Experiments, electrolysis copper chloride	V	202

* See Summaries, page 128

	Vol.	Page
Coinage:		
MACDONALD, notes by	VI	350
Nickel	VI	37
	IV	184
for, note by MILLER	V	248
Platinum	VI	37
	VIII	193, 194
Coins:		
Gold alloyed with platinum	VIII	193
Coke:		
Analysing	X	450
Blast furnace practice:		
charge	IV	241
	IX	408
per ton of pig iron	VI	8
combustion	VIII	120, 123
compared with charcoal	II	47
functions	VIII	138
Canadian production .1900	V	565
1902	VI	454, 455
in Coal seams from volcanic action	VIII	240
for Domestic use	IV	141
Electric smelting:		
charged with iron	VIII	137, 141, 142
Free importation of coal for making	IX	26
from High sulphur coals	IV	11
Manufacture:		
Bessemer patent	IX	330
from Briquettes of non-coking coal	IX	327
Cooling	IV	169
HARDIE, notes on, by	IX	208
Ogmore patent	IV	236
Percentage of, from coal	IV	138
	VIII	300
Retort compared with oven	IV	137
Smelting, first used in	VI	32
Water gas plant, charge for	VIII	293
percentage of, in	IV	136

British Columbia.

BLAKEMORE, paper by, on industry	VI	224–232
Costs of imported	IV	236
Production 1900-1	V	572
1902	VI	453
to 1906	X	183, 185

Boundary Dist., smelter charge	V	177
Kitchener, cost at	V	79
Kootenay East, profits on	VI	230
Coal Creek, manufacture at	IV	169
quality	IV	235
	VI	228, 230
Crowsnest, consumption	VI	230
price	IV	236
quality	IV	157, 236

	Vol.	Page
Coke—Con.:		
British Columbia—Con.:		
Kootenay East—Con.:		
Fernie, automatic method of handling..	IV	241
time of burning	IV	241
Vancouver Island,		
Comox	VI	196
England.		
Brayton Domain colliery, manufacture	IX	408
Ontario.		
Copper Cliff smelter, charge	V	546
Iron industry, consumption 1898-1900	IV	302
Norway.		
Price of	VII	406
Nova Scotia.		
Cape Breton, analysis	IV	11
ash in	IV	141
Nova Scotia Steel Co.	IV	11
consumption	IV	35
Production 1899	III	189
1901	V	583
1902	VI	453
United States.		
Colorado, quality of	IV	235
Connelsville, Pa., quality of	IV	235
Yukon		
Tantalus, analysis	X	217
Coke ovens:		
Alabama, U.S.A.	IV	26
Brayton Domain colliery, Eng.	IX	408
Coal Creek, B. C.	IV	169
Comox, V. I., B.C.	VI	196
Coppee,	IV	236
Dominion Iron and Steel Co.'s plant, plan of	IV	12
Everett, Mass., by-product	IV	11
Fernie, B.C.	IV	241
Ferrona, N.S.	IV	35
Frank, Alta	V	110
Gas (see gases)		
Otto-Hoffman, Sydney, C.B.	IV	11, 12
Sydney, C.B.	IV	11
Coking coals:		
Cardston, St. Mary River, B.C.	IV	234
Free hydrogen in	VIII	238
Kettle River, B.C., north fork of	IV	229
Pennsylvania, U.S.	IV	24
Rocky Mts. foothills	V	112
Skeena Div., B.C.	X	224
Colbert	IX	4
Colborne, Sir John	IX	87
Colchester Co., N.S.		
Copper ores	IV	311
	V	584
Cole, Arthur A.		
Min. Ref.	X	19

	Vol.	Page
COLE, L. HEBER.		
Awarded President's gold medal	IX	8, 25
***Mine Surveying as carried on at Centre Star Mine,** ROSSLAND, B.C	VIII	317–335
COLEMAN, Dr. A. P.		
Discussion by, on:		
The Exploration of Ontario's Iron Ranges	VII	264
Magmatic Waters	X	309, 312, 313, 314
The Ore Deposits of Rossland, B.C	VII	59
Some Mining Camps in the Lardeau Dist., B.C.	VII	111
Notes by, on:		
Diamonds in Rainy Lake region, Ont	III	159
Iron ore deposits of Algoma Dist., Ont	IV	280
Report by, on Ontario gold areas	VII	125
Min. ref	IX	294, 334
	X	121, 125
Coleman-Blairmore coalfields, Alta.:		
Coal seams	X	230,232
Coleraine, MEGANTIC CO., QUE.		
Chromite industry, 1898	II	62
mining in	II	25
production 1900	IV	308
Coll, Chas. J.		
Elected Councillor of Institute 1905	VIII	34
1906	IX	27
Collieries: *see also* Coal and Coal Mining.		
Acadia, Stellarton, N.S	IV	34
Crowsnest Pass, B.C	III	185, 187
Coal Creek	IV	155–173
	VII	502
Cumberland, Eng., Brayton Domain	IX	402–412
Dominion Coal Co	IV	27–30
Drummond, Westville, N.S	IV	34
Gold Creek, Alta	VI	375
Lethbridge, Alta	V	106
Nova Scotia	VI	448
North Sydney	IV	61
Port Hood	IV	310
Port Morien	IV	310
No. 6 Susquehanna Coal Co	IV	42
Vancouver Island, B.C	VI	195
Colliery explosions: *see also* Explosives, Accidents, Blasting, Coal mines, Lamps, Fire-damp, etc.		
Allerton, Yorkshire	V	384, 386
ASHWORTH, paper by	V	379, 392
Bryncock, S. Wales	V	382
Caused by safety lamps	V	379 et seq
Fernie, B.C	V	379, 382
	VI	206
BLAKEMORE'S views on	VI	201
Fraterville, Tenn	V	379
HARDIE, theory of "hydro-carbons in coal dust"	VI	202 et seq
Seaham, result of enquiry into	VI	205

* See Summaries, page 107

	Vol.	Page
Colliery explosions—Con.,		
Senghenydd, S. Wales	v	379
Shakerley, Lancashire	v	385
Shirebrook, Nottinghamshire	v	386 et seq
South-West Virginia Improvement Co., Pocahontas, Va.,	vi	204
Universal Colliery, Galloway's report on cause of	vi	202
Whitfield, N. Staffordshire	v	382
Wigan, England	v	390
Wishaw, Scotland	v	383
***COLLIERY MANAGER, THE.** HARDIE	ix	200–209
Collingwood, Ont.		
Natural gas	iii	68
Oil-wells	vi	98
Collins, George E.		
Quoted on membership qualifications for mining societies	x	327
Collins Gulch, B.C.		
Coal analysis	vii	424
Collin's Shaft, BRUCE MINES, ONT.	x	159
Colonial Copper Co., CAPE D'OR, N.S.	v	584
Colorado, U.S.A.		
Coke, quality of	iv	235
Gas tests on coals from	ix	325
Colorado Zinc Works:		
Zinc Separation	vi	12
COLQUHOUN, A. J.		
†*Notes on the Occurrence of Quicksilver in Canada*	ii	13–16
Columbia, S. AMERICA.		
Gold production, 1801–1900	vi	25
Platinum production	viii	194
Columbia Kootenay mine, ROSSLAND, B.C.		
Production 1894–1904	vii	47
Columb'a Mt., GOLDFIELD, NEVADA	viii	40
Columbia River, BRITISH COLUMBIA.		
Ore deposits, notes by CORLESS	v	505
Columbia and Western Railway	v	171
Columbite:		
Economic value, notes by MILLER	vii	256
Ontario occurrences	vii	254
Colzalene: *see* Benzolene		
Comaplix, ARROW LAKE, B.C.	vii	87
Combermere, ONT.		
Corundum near	iv	183
Combination gold claim, GOLDFIELD, NEVADA	viii	39, 43
Combustion (*see also* Calorific power, Fuel etc.)		
Coal gas	iv	138
V. B. Lewis' experiments	iv	139
Comet crusher	iv	223
S. Africa diamond mining	v	75

* See Summaries, page 118
† " " 3

	Vol.	Page
Comox, VANCOUVER ISLAND, B.C.		
Coke manufacturing	VI	196
Formation at	VI	195
Companil Iron mine *see under* Spain.		
Company Law:		
British Columbia	III	206
California	X	321–335
CLARK, paper by, on	IV	244–253
Great Britain, 1900, provision of	IV	246
respecting "False Statements"	IX	281
Liability of directors	IV	248
Ontario	III	116, 117
notes by COSTE	X	330
Provision respecting issuing shares at discount	IV	79
***COMPANY LAW** CLARK	IV	244–253
†***COMPARISON OF COSTS OF COMPRESSED AIR WITH STEAM AND ELECTRICITY AT ROSSLAND, B.C.,*** THOMPSON	VI	180–187
Compass:		
Gurley pocket, adaptability of for mine surveying	IV	101
Robbin's appliance	IV	101–106
‡***COMPOSITION OF SOME CANADIAN LIMESTONES, THE*** DONALD	IV	152–154
Compressed Air:		
Belmont mine, Cordova, Ont.	VI	233
Chutes, opened and closed by	V	332, 342
Costs, steam compared with electricity (THOMPSON)	VI	180–187
Haulage by	IV	42
Hoisting by	VI	305
Locomotives driven by, Anaconda copper mine, Mont.	V	161
Mine-signalling, paper by MACDONALD and THOMPSON	VI	161–168
Pumping by	III	128
, paper by KIRKEGAARD	V	265–273
Use of, in gassy coal-mines	VI	449
¶***COMPRESSED AIR*** SAUNDERS	V	156–163
"Compressed cartridge"		
Composition and use as a blasting agent in coal mines	I	5, 6
Compressor plant:		
Belmont Gold mine, Ont.	VI	233–244
plan	VI	240
Compressors:		
Coal consumption	V	327
Deloro mine, Ont.	V	269
Efficiency	II	131
tests	II	136
Indicator cards	VIII	288
Rand two-stage	II	130
SAUNDERS, notes by, on	V	156–163
Simplon tunnel, Switzerland	II	139

* See Summaries, page 35
† " " 64
‡ See Summaries, page 30
¶ " " 44

	Vol.	Page
Comstock concentrator, SLOCAN DIST., B.C	VI	152
Comstock Lode, NEVADA, U.S.A.		
Discovery	VI	26
Production	VI	26
Timbering	VI	129
Concentrate:		
Athabasca mill, Nelson, B.C	IV	88
Bromo-cyanide process, treatment of	IV	118
Bruce mines, Ont	X	152, 168
Camp McKinney, B.C., value	II	144
Cariboo hydraulic mine	X	423
Corundum	V	167
Extraction of gold from, by bromo-cyanide process	IV	151
Galena, Slocan Dist., B.C	VI	153
Gold-arsenic, Deloro mine, Ont	IV	122
Graphite, treatment of	X	92
Lead, Helena Frisco mill, Idaho	IV	258
Lead-silver, Wright mine, Timiskaming, Que	IV	308
Mispickel-iron pyrites, leaching of	IV	145
Roasting	VII	311
Slocan Star mine, Sandon, B.C	V	509
Ymir mine, B.C	III	10
Concentrating mills:		
Alamo, B.C	III	20
Deloro, Ont	IV	119
Helena Frisco Con. Co., Gem, Idaho	IV	254 et seq
St. Eugene, Moyie, B.C	V	512
CONCENTRATION OF ARGENTIFEROUS GALENA AS CARRIED ON AT HELENA FRISCO CONSOLIDATED COMPANY'S MILLS, IDAHO, U. S. A., EDWARDS	IV	254–264
Concentration: *see also* Magnetic Concentration, Milling-Practice, Ore Dressing, etc.		
Costs:		
how chargeable in mine accounting	III	49
considerations	III	103, 104
Factors in	III	108
General law	III	102
Ratio of investment to saving by increasing plant	III	104
Relation of type of machine to ore particle	III	109
Rossland Dist., B.C	VII	68
Size of product	III	107
Slocan Dist., paper by FOWLER	VI	146–160
SNYDER, paper by, on factors of	III	102–109
Tests	III	104, 107
Arsenopyrite, Deloro mine, Ont	IV	117–118
Barytes	III	108
Black sands, *see* Iron.		
Chromite	II	26, 62
	V	7
	IX	35

* See Summaries, page 35

	Vol.	Page
Concentration—Con.:		
Copper:		
Bruce Mines, Ont.	VII	144
	X	160
Butte, Montana	III	170
Vancouver Island	IX	48
Corundum:	III	203
	VII	160, 415
N. Carolina	V	165
FAIRLIE, paper by	V	164–170
Diamonds:		
S. Africa	V	72 et seq
Galena:		
Cœur d'Alene, Idaho, paper by EDWARDS	IV	254–264
Clausthal, Germany	IV	263
St. Eugene mine, Moyie, B.C.	V	512
Slocan Dist, B.C.	III	20
	VI	146–160
Gold:		
DEKALB, notes by	IV	193 et seq
Nova Scotia	II	236
	VII	308
Gold-silver ores, Bridge River Dist., B.C.	III	27
Graphite, notes by BRUMELL	X	92
Iron:		
BENNIE, paper by	X	261–273
CIRKEL, notes by	X	111
SNYDER, paper by	VII	270–277
Sweden	II	38
WELLS, paper by	VI	6–20
Iron Sands	IV	91–2
	V	9
	VIII	156
Lead:		
Hollandia mine, Ont.	VII	157
Manganese	VII	276
Molybdenite	VI	51 et seq
	VII	164
experiments at McGill University	V	7
Nickel	VII	279, 280
Silver:		
Slocan Dist., B.C.	III	20
	V	13
	VI	146–160
Zinc, Slocan Dist., B.C.	VII	371
Zinc-lead, Blake-Morscher system	VI	19
Concentration: (natural)		
Athabasca mine, Nelson, B.C.	V	16
Atlin District, B.C.	V	24 et seq
Cobalt Dist., Ont.	X	46
Corundum	V	164
Goldfield, Nev	VIII	44
Iron ores, Nastapoka Islands, Hudson Bay	V	257
Nickel in peridotite	IV	186
Sudbury Dist., Ont.	V	538

	Vol.	Page
Concentrators:		
Bruce Mines, Ont.	VII	145
Five Mile, Lardeau Dist., B.C.	VII	98, 99
Hooper pneumatic.	V	170
Moving bed type of.	III	108
Slocan dist., B.C.	VI	152
	VII	372
Conception Bay, NEWFOUNDLAND:		
Iron ore deposits.	IV	63
Concrete:		
Paper by LEONARD.	VIII	102–110
Congdon, T. J., M P.	VIII	38
Conglomerates:		
Bear Lake, B.C. auriferous	III	95
Cascade Coal Basin, Alta.	VIII	226
Cobalt Dist., Ont.	X	49
Notes by BELL.	X	64
Franklin Camp, B.C.	X	71
Lake Mistassini, Que.	IX	19
Lardeau Dist., B.C.	VII	89
New Glasgow, N.S.	V	359
deposition of	V	362
Oaxaca, Mexico.	VIII	273
Pense Tp., Ont.	X	70
Poplar Creek Dist., B.C.	VII	104
Rossland Dist., B.C., Lake Mt.	V	520
Conkling, G.	X	262
Conkling magnetic separator:		
Diagram.	VI	20
Notes on, by WELLS.	VI	13
Conley, Alta.		
Geology.	VII	423
Connellsville, Pa.		
Coke analysis.	IV	235
Conrad City, WINDY ARM, Y.T.		
Situation of.	IX	49
Conrad Consolidated Co., WINDY ARM, Y.T.	IX	52
Conrad Mining Division, Y.T.		
Geology of and mining in, notes by CAIRNES.	X	210
Conservation:		
Forestry.	II	52
in Sweden, methods.	II	47, 215
Mineral resources, Douglas' views on.	V	152
Sawdust for calcium carbide manufacture.	II	232
Consolidated Alberni Gold Mines, ALBERNI, V.I.	VI	197
Consolidated Cariboo Hydraulic Mining Co., BARKERVILLE, B.C.	IV	294
	V	573
Construction expenditures.	VI	324
Contact deposits:		
Pacific Coast, notes by BREWER.	X	203
Sudbury Dist., Ont.	V	529
Texada Island, B.C.	X	245
Yerington, Nev.	X	259

	Vol.	Page
Contact metamorphism:		
Belmont, Ont.	VII	219
Boundary Dist., B.C.	V	371 et seq
Poplar Creek Dist., B.C.	VII	106
Contract labour:		
Le Roi mine, Rossland.	V	323, 324
Controller's Bay coalfield, Alaska:		
Report on, by Coste	VIII	242
"Conularia":		
Boisdale Hills, C.B.	VI	416, 427
Converters:		
Canadian Copper Co., Copper Cliff, Ont.	V	549
Charge, Ulke nickel process.	V	394
Greenwood smelter, B.C., description.	IX	357
Lining for.	V	549
Slag, analysis.	V	549
Conveyors:		
Belts.	III	34
Le Roi mine, Rossland.	V	331
Brown cantilever	III	35
Chicago drainage channel, use of	III	33
Gould.	III	34
Incline,	III	33
Wabana iron mines, Nfld.	III	132
	IV	66
Cook gold mine, Marmora Tp., Ont.	VII	118, 120
Cook Land Co., Deloro, Ont.	VII	121
Coolgardie, W. Australia:		
Gold discovery.	VI	27
Cooper, A. S.		
Quoted on the origin of petroleum.	VI	96
Cooper, James:		
Death of.	VII	3
Coppee coke-ovens	IV	236
Copper and Copper Mining:		
Assaying.	IV	225
Bars, method of sampling.	II	108, 109
Bartlett-Thompson separation of.	V	192, 212
Casting	II	115
Electrolytic production, notes by Ulke	V	393
paper by Koehler	V	189 et seq
(diagram)	V	209
-nickel, Hoepfner process	V	203, 393
sulphate.	V	190
Geology of, paper by Kemp.	X	251–256
Glance, at depth	X	252
Industry, notes on, by Miller	VI	34
in Canada, paper by Hobart	VI	313
Leaching.	IV	123
Magnetic separation.	VII	277
Melting	V	7
Pigs, segregation of precious metals.	II	109, 113
Plates, amalgamation	IV	116
Athabasca mill, Nelson, B.C.	IV	86
cleaning.	IV	195
notes on, by DeKalb	IV	192

	Vol.	Page
Copper and Copper Mining—Con.:		
Platinum associated with	VIII	198, 203, 206
Price of, 1853-1858	X	161
Refining, notes on, by KOEHLER	V	192, 396, 400
ULKE	V	393
Sampling	II	108
Smelting of	IX	59
Statistics:		
Canadian 1901	V	569
1902	VI	454, 455
1903	X	12
JOHNSON, notes by, on	VI	69
Types of deposits of	X	177

Baffin Land.

East side of	VIII	22

British Columbia.

Industry 1900	IV	293, 295
Ores of	VIII	172–182
Statistics 1900-1901	V	572
1902	VI	453
Atlin Dist.	III	100
Wright Creek	III	98
Lake	III	100
Boundary District:		
BROCK, paper by	V	365 et seq
CORLESS, notes by	V	514
King Solomon mine	V	375
LEDOUX, paper by	V	171-177
Matte	V	174
Mother Lode mine	VII	42
	IX	334
ores	V	213 et seq
Native	V	375
Statistics, notes by LEDOUX	V	171
Values in	VI	228
Cariboo Dist.	V	325
Franklin Camp	X	173
Golden, E. Kootenay	III	185
Nicola Dist. ores	IV	229
Pacific Coast	IX	39 et seq
Deposits, paper by BREWER	X	195
Ores of	III	183
Rossland	II	76
	VII	51
Similkameen Dist.	IV	229
	V	493 et seq
Telkwa River	X	221
Texada Island:		
Marble Bay mine, paper by LEROY	X	242–256
Notes by CAIRNES	X	215

	Vol.	Page
Copper and Copper Mining—Con.		
British Columbia—Con.		
Vancouver Island	VI	189
	IX	39 et seq
BEST, notes by	V	228 et seq
BREWER, notes by	VI	191
Mount Sicker	V	229
	VI	194
West Kootenay	II	75
Chili.		
Bars, method of sampling	II	108
China.		
Market for	VIII	159
New Brunswick.		
Royalty on	VII	456
Norway,		
Deposits	VII	402
Nova Scotia.		
Mining in 1900	IV	311
Ores of	III	189
Royalty on	VII	458
Statistics 1899	III	189
Boisdale Hills, C.B.	VI	430
Cumberland County	V	584
New Annam, mines of	III	189
Wentworth, mines of	III	189
Ontario		
Occurrences, notes by MILLER	VII	383
Resources and industry, notes by MILLER	V	235 et seq
Statistics 1893-1903	VII	391
1900	IV	300
1901	V	581
1902	VI	454, 464, 465
1903	VII	425, 429
Algoma, Iron Bridge, Gladstone Tp	VII	180
Shakespeare Tp.	VII	121
Atikokan Dist	IX	298
Bruce Mines,	X	149
Production 1846-1875	VII	144
Nipissing Dist	IV	277
Sudbury Dist:		
Copper Cliff	III	244
	V	536
notes by CARTER	VII	143
Wallace Mine	III	224
Quebec.		
Industry 1899	III	188
Statistics 1900	V	350
Chibougamau region	IX	20, 219, 221
	X	105

	Vol.	Page
Copper and Copper Mining—Con.:		
Quebec—Con.		
Eastern Townships	II	12
	V	82, 85
Acton	III	188
DRESSER, papers by	V	81–86
	VII	397–399
Harvey Hill	II	62
	III	188
United States.		
Butte, Mont., veins, paper by BRADEN	V	296–301
Highland Boy, Utah, smelting	VI	306 et seq
La Touche Is., Alaska	IX	45
Lost Packer Lode, Idaho	IX	54
Keweenaw Peninsula, Mich	X	399
North Arizona, ore deposits	IV	125
Yerington, Nev., genesis of, paper on by JENNINGS	X	257–260
Yukon.		
Ores of	VIII	172–182
Whitehorse, notes by CAIRNES	X	214
Windy Arm	IX	51
***ON THE COPPER BEARING VOLCANIC ROCKS IN THE EASTERN TOWNSHIPS OF THE PROVINCE OF QUEBEC** DRESSER	V	81–86
Copper Camp, BOUNDARY DISTRICT, B.C.		
Copper ores	V	375
Copper Cliff, SUDBURY DIST., ONT.		
Greenstone	V	529
Smelting works at	IV	301
	V	546
	VII	149
Nickel mine:		
Acquired by Canadian Copper Co.	VII	497
CARTER, notes by	VII	148
Minerals in ores of	X	276
Ore deposit	V	529
	VII	498
notes by SILVER	V	532
Platinum in	VIII	204
Copper Creek, KAMLOOPS DIST., B.C.		
Discovery of cinnabar at	II	13
Copper Crown Mining Co., PICTOU, N.S.	IV	311
Smelting works	III	189
Copper Island, BARCLAY SOUND, V.I., B.C.		
Iron ores	V	229
	VI	199
Copper King claim, WHITEHORSE, Y.T.		
Shipments from	VIII	179
	X	197
Workings on	IX	40
Copper Lake, Nova Scotia.		
Gold discovery at	II	165

* See Summaries, page 41

	Vol.	Page
Copper Mining and Smelting Co., of Ontario	x	158
Copper Mt., SIMILKAMEEN DIST., B.C.		
Copper ores	iv	229
	viii	174
Formation at	viii	179
Ore deposits, paper by SCOTT	v	493–502
Copper pyrites:		
Copper Mt., Similkameen Dist., B.C.	v	498
Ferguson, Lardeau Dist., B.C.	vii	98
Quebec production 1901	v	570
Rainy River Dist., Ont	vi	333
Rossland Dist., B.C.	v	452
Copper Queen mine, TEXADA ISLAND, B.C.		
BREWER, notes by	viii	173 177,
LEROY, notes by	x	245, 250
Map of	x	247
Vein at depth on	x	197
Workings on	ix	40
Copper River, Alaska:		
Copper on	x	196
Copper River, SKEENA DIV., B.C.		
Coal discovery	x	223
Cordilleran:		
Mexico	viii	272
Mineral production from	vii	468
wealth of, notes by MACDONALD	vi	339 et seq
Cordova, PETERBOROUGH CO., ONT.		
Formation at	vii	216, 218
Gold mine	vi	233
Corewo Asbestos mine, ASIATIC RUSSIA	vi	372
CORKILL, E. T.:		
Notes on the Occurrences, Production and Uses of Mica	vii	284–303
CORLESS, C. V.:		
Awarded Institute's Gold Medal	v	559
†***Coal Creek Colliery of the Crow's Nest Pass Coal Co.***	iv	155–173
‡***Notes on the Geology and a few Ore Deposits of South Eastern British Columbia***	v	503–527
Corliss valve engines:		
Le Roi Mine, Rossland, B.C.	vi	182
Cormack, George:		
Discovery of gold in Yukon by	v	598
Cornell copper mine, TEXADA ISLAND, B.C.	viii	176
LEROY, notes by	x	245, 250
Map of	x	246
Corniferous formation:		
James Bay	vii	387
Maidstone Tp., Ont., petroleum in.	iii	74
Oil and gas in	vi	112
Oil Springs	iii	82
Ontario oilfields	vii	427
Petrolea, Ont.	iii	82
Petroleum in, notes by BELL	vii	394
Tilbury oilfields, Ont.	x	82

* See Summaries, page 83
† " " 30
‡ " " 57

	Vol.	Page
Corning, OHIO, U.S.A.		
Oilfields	VI	117
Cornish pumping engine:		
Description	III	147
Cornwall, PENN, U.S.A.		
Iron concentration at	X	270
***CORRECTION IN THE CLASSIFICATION OF OUR GOLD FORMATION, A.,** HILLE	VIII	183–191
Corundum:		
Abrasive qualities	III	201–203
in Aluminium manufacture	III	203
Canadian statistics 1906	X	12
Cementing	V	250
Chemical composition of	VII	416
Concentration of	III	203
Determination of in rock, notes by GOODWIN	IV	180–183
Drill-bits	VI	5
Furnace lining with	IX	129, 131
Magnetic separation of	VII	276
Market	III	202
Method of mining	V	165
Mining and concentration, paper by FAIRLIE	V	164–170
North Carolina	III	200, 201
	V	165
occurrence	III	201
Occurrence, mode of	V	242
Price as compared with emery	III	201
Sohland, Germany	IX	254
Specific gravity of	VII	416
Uses of	VII	420
Ontario.		
Combermere, Craigmont near	IV	183
Deposits	III	200–201
Discovery of	VII	412
Eastern	III	200
Industry and resources, notes by MILLER	V	242
Methuen Tp	VII	305
Mines of, notes by CARTER	VII	159–160
Occurrence	III	150, 196, 200
BAKER, paper by,	VII	410–424
MILLER, notes by,	VII	385
Production 1901	V	581
1902	VI	464
1903	VII	391, 426, 430
Renfrew County	III	202
Quality	III	200
Corundum Refiners, Limited	VII	160, 416
Costs:		
Accounting	III	37–67
S. Africa	III	51
Anthracite coal breaker	IX	290
Blasting	IX	343
powder	IV	172
squibs	IV	172
Boring, Lake of Woods Dist., Ont	II	238

* See Summaries, page 100

	Vol.	Page
Costs—Con.:		
Coal:		
Breaker	III	51
Coal Creek, B.C. mining	IV	169
Gas from	IX	325
Hawaiian Islands	VIII	59
Yukon, transportation of	IV	297
Coke:		
in British Columbia	IV	236
Compressed Air	V	327
Electric plant	VI	186
Signal system, installation	VI	167
Steam vs. electricity	VI	180–187
Concentration:		
Iron	VII	274
Magnetic	X	271
compared with water	VII	277
Rossland, B.C.	VII	69
Slocan Dist., B.C.	VI	159
	VII	204
Conveyors, operation of	III	33, 34
Copper:		
Mining, Keweenaw Peninsula	X	415
Boundary Dist., B.C.	V	176 et seq
Leaching	IV	124
Smelting, Boundary Dist.	V	177
Crushing	V	318, 336, 337
	VII	283
Dredging:		
Chicago Canal	III	33, 34
for Gold	V	96
New Zealand	IV	298
Drifting *see* Mining *below*.		
Drilling	III	35
	IX	343, 389
Diamond	VI	3
	IX	319
Electric Smelting	III	138
iron	VIII	142
Flume, wooden	VI	237
Freight and treatment of ores:		
Lardeau Dist.	VIII	101
Slocan Dist.	V	13
Gold:		
Dredging	IV	298
	V	96
Milling	III	103, 104
Golden Star, Ont.	VII	138
Republic, Wash.	V	278
Pelatin-Clerici process	V	275
Mining, Oldham, N.S.	X	433
Haulage *see under* Mining.		
Heating	VIII	301
with gas	IX	325
Hoisting *see under* Mining.		
Illuminants	VIII	300
Acetylene gas	II	232

	Vol.	Page
Costs—Con.:		
Mine-bulkheads	VII	85
Mining:		
Blasting	IX	343
Drilling	IX	343, 389
Golden Star, Ont	VII	138
Haulage	VIII	349
Le Roi mine, Rossland	V	314
hoisting	V	316, 318 336, 337
sampling	V	318, 336 337
sinking	V	416
tramming	V	316, 337
Quicksilver	II	16
Shovelling	IX	345
Stoping, Rossland Dist	V	340, 477
Slocan Dist	V	13
	VII	205
Timbering, Rossland Dist	VI	136–139
Tramming, Ymir mine	III	8
Monthly statements of	III	39
Oil:		
Locomotive fuel	VIII	66
Lubricating	IV	172
Power:		
Mother Lode mine, Boundary Dist	VII	44
Pumping	VII	81
Deloro mine, Ont	V	266
Roasting	VII	487
Highland Boy, Utah	VI	310
Smelting:		
Northport, Wash	V	341
Rossland Dist	V	311 312, 314
	VI	228
Steel:		
Electric manufacture	VIII	147, 150
Lining for shafts	VII	361
Sulphuric Acid:		
Manufacture	VII	492
Topographic Surveying	IX	82
Transportation:		
Cariboo Dist., B.C	VI	325
of Material by cableways	III	35
Rossland Dist	V	314, 316, 334
	VI	228
Slocan Dist, on zinc	VII	372
Water gas plant	VIII	295
Cost accounting:		
Forms for use in	III	54–67
Method of	III	37–67
Cost minute book	III	45
COSTE, EUGENE.		
Address by as President C. M. I. 1904	VII	26–41
1905	VIII	13
Discovery of natural gas, Ontario, by	VII	174

COSTE, EUGENE—Con.:	Vol.	Page
Discussions by, on:		
Acetylene Gas as a Mine Illuminant	II	231
Are there Diamonds in Ontario?	III	196
the Artesian and other Deep Wells on the Island of Montreal	VIII	98, 100
the Bedrock of the Gilbert River Gold-Fields	VIII	262
the British Columbia Zinc Problem	VII	373, 375
Canadian Metallurgical Products for the Far East	VIII	160, 161
Description of the Sultana Quartz Lode	II	238, 240, 241
The Distribution of Platinum Metals in Sources other than Placers	VIII	213
Economic Geography	VI	468
Electric Smelting	VIII	155, 157
Gold Measures of Nova Scotia and Deep Mining	II	250
Life History of Coal Seams	VIII	241, 242
Mine Taxation in Ontario	X	13
The Mining Laws of Ontario	III	204
Mining Statistics	VIII	167
A new and hitherto unrecognized Geological Formation in the Gas and Oil Producing Regions of Ontario	II	207–211
A New Mining District in Northern Quebec	VIII	366
A Note on Varieties of Serpentine in South Eastern Quebec	VIII	269–271
The Old Valley Gravels of the Klondike	III	209–214
The Ore Deposits of the Cobalt Dist., Ont	X	60
The Ore Deposits of the Rossland Dist., B C	VII	58, 67, 69
The Stratigraphy of the Cascade Coal Basin	VIII	233–234
The Status of the Mining Profession	X	330
The Value of an Undeveloped Mineral Claim	VIII	118
Some Laboratory Experiments in making Steel from Iron in the Electric Furnace	IX	134
West Kootenay Notes	III	199
Elected president of Institute 1903	VI	479
1904	VII	22, 23
Vice-president 1902	V	603
Notes by:		
Canadian iron industry	IX	15
mineral production	X	12
Petroleum in Cinnabar mines	VIII	181
production	VI	466
Papers by:		
**A few suggestions on Mineral Statistics*	VI	408–410
†Natural Gas in Ontario	III	68–89
‡New Tilbury and Romney Oilfields of Kent County, Ont., The	X	77–84
‖Suggested Improvements to the Mining Laws in Canada	VII	450–466
°On Uniform Mining Statistics in Canada	VIII	169–171
¶Volcanic Origin of Natural Gas and Petroleum	VI	73–128
Report by, on Lake of the Woods Dist.	II	238–240
Sultana Lode	II	87
Representative of Institute to oppose Bill of Can. Society Civil Engineers	II	259

* See Summaries, page 73
† " " 18
‡ " " 129
‖ See Summaries, page 89
° " " 99
¶ " " 61

	Vol.	Page
COSTE, EUGENE—Con.		
Views of, on:		
Branches of Institute	VIII	10, 11, 15
Civil Engineers' Bill	V	561
Canadian Geological Survey	V	591
Mineral Statistics computation	VI	459
Remuneration of government geologists	VII	449
Vote of thanks	VIII	36
Min. refs	VI	481, 483, 484, 486
	VII	2, 10, 12, 14, 20, 22, 37, 38, 210, 408, 430, 444
	VIII	181
	IX	13
	X	15, 20
Coste Well No. 1, RUTHVEN, ONT.	II	208
Depth	III	68
Production	III	68
Costigan coalfield, ALTA.		
Coal, hardness	X	232
seams	X	231, 232
Coteau, The, MOOSE JAW DIV., SASK.		
Edmonton series	VIII	223
Laramie area of	X	235
Couldrey, Paul S.	VII	58
Country Harbour, N.S.		
Gold quartz veins	II	248
Couplands Lake, SHERBROOKE CO., QUE.:		
Rocks at	IX	213
Coutchiching series:		
Atikokan, Ont	IX	288
Western Ontario, notes by BRENT	VI	327
rocks	V	50
Covellite:		
Rambler mine, Wyoming	VIII	205
Sperrylite associated with	VIII	198, 199
Yerington, Nev	X	259
Cowan, E. P.		
Nickel and cobalt discovered by, in Quebec	II	63
COWEN, R. P.		
****Number Four Pit, Brayton Domain Collieries, Cumberland, England***	IX	402–412
Prize awarded to	X	6
Cowgitz coal mine, QUEEN CHARLOTTE ISLANDS, B.C.		
Coal analysis	VIII	237
Cowley coalfields, SASK.:		
Coal analysis	VII	424
Coxcomb Mt., JUMPING POUND CREEK, ALTA.:		
Coal, hardness	X	232
seams	X	232
Coxheath Hills, BOISDALE HILLS, C.B.	VI	411

* See Summaries, page 126

	Vol.	Page
Craig, B. A. C.:		
Discussions by, on:		
The Geological Survey as an Educational Institution	VII	439, 444, 447
Magnetic Concentration	VII	278
The Study of Stratigraphy	VII	174
Suggested Improvements to the Mining Laws in Canada	VII	477, 478
Note by, on Quebec mining laws	X	19
Resolution on Ontario mining taxation, moved by	X	14
Views on methods of computing mineral statistics	VI	459
Min. refs.	VII	414, 432
CRAIG, W. DIXON:		
**The Modern Blast Furnace Laboratory and its Work*	VI	288–300
Paper by, Ref. to	VI	471
Craik, S.	X	361
Crane nickel mine, SUDBURY DIST., ONT. (*see* Worthington mine)		
Crawford Creek, B.C.		
Cinnabar	III	144
Crazie's Shaft, BRUCE MINES, ONT.	X	159
Creek gravels:		
Yukon, gold values in	III	212
Creighton nickel mine, SUDBURY DIST., ONT.		
CARTER, notes on, by	VII	149
Formation at	IX	225
Minerals in ores of	X	276
Opening of	V	579
Origin of ore bodies at	VII	59, 65
Pentlandite	V	534
Values in ores of	VIII	213
Crested Butte, COLORADO, U.S.A,		
Coke analysis	IV	235
Cretaceous:		
Alberta, coal horizons	X	229 et seq
America, Western	IV	156
Anthracite, Alta	II	17
Bankhead, Alta	VIII	215
Belly River series	VIII	221
Blairmore, Alta	VII	422, 424
Canada, Western:		
coalfields in	VII	422, 500 et seq
history	X	229
Canmore, Alta	II	17
	VII	422, 424
Crowsnest Pass, B.C.	IV	231
	VII	422, 424
measures, thickness of exposures	IV	232
Edmonton series	VIII	223
Formation of coal beds	VIII	221
Frank, Alta	VII	422, 424
Kootenay Pass, North:		
measures, thickness of	IV	233
series	VIII	221

* See Summaries, page 67

	Vol.	Page
Cretaceous—Con.:		
Manitoba, coal horizons	x	229 et seq
Ouachuta and Arbuckle Mts., Indian Territory, U.S.A.	vi	113
Port Simpson, B.C.	vii	424
Queen Charlotte Islands	vii	424
Rocky Mts., coalfields	viii	234
deposits, thickness of	v	107
foothills	v	106
"The Gap"	iv	233
lower system	vii	422
Saskatchewan, coal horizons	x	229 et seq
Skeena River Div., B.C.	x	223
Somorrostro Dist., Spain, upper	iv	198
System, coal-bearing horizon	viii	221 et seq
Texada Island, B.C.	viii	175
	x	244
Vancouver Island, B.C.	vi	189
	vii	424
Yellowhead Pass, B.C.	vi	226
Yukon, formation, lignite in	iii	212
Cribbing:		
Framing timber for	v	430
Cripple Creek, COL., U.S.A.		
Gold discovery	vi	27
production, notes by MACDONALD	vi	345
Criss Creek, B.C.	ii	14
Croasdaile, H.E.		
Discussion by, on		
The Influence of Government on Mining	vi	366, 369
Effect of 8-hour law in British Columbia mines	iii	171–173
Cromwell mineral claim, LARDEAU DIST., B.C.	vii	101
Cronin, James	vi	440
Crookes, Sir W.		
On the origin of diamonds	iii	196
Cross Lake, TIMAGAMI DIST., ONT.:		
Jaspilyte	iv	278
Croton iron mine, NEW YORK, U.S.A.		
Magnetic concentration	iv	17
Crowfoot Creek, BOW RIVER, ALTA.:		
Coal at	x	236
Crown Grant:		
Mineral claims, British Columbia	vii	467
Crown Point mine, ROSSLAND, B.C.		
Vein	v	522
Crowsnest Lake, B.C.		
Coal-bearing horizon	iv	233
Crowsnest Pass, B.C.: *see also* Coal, Coal Creek, Fernie, Michel, Morrissey.		
BLAKEMORE, paper by, on pioneer work in	iv	230–243
Coal analysis	vii	424
mining in, notes by McEVOY	vii	500–504
quality of	vi	226
seams, entries to	iv	237
Coke analysis	iv	235

	Vol.	Page
Crowsnest Pass, B.C.—Con.:		
Discovery of	IV.	230
Faults	IV	231
Fuel ratios	X	230–232
Geology	VII	422, 502
Kootenay, series in	VIII	221
Map	IV	230, 240 (opp.)
Resources	VIII	243
Timber in	IV	234
Workable area	IV	232
Crowsnest Pass Coal Co., B.C.		
Coal and coke, prices of	VI	228, 230
Coal Creek colliery	IV	155–173
Coke ovens	IV	241
Conditions 1899	III	185
Explosion at Fernie No. 2 Colliery	V	379, 382
	VI	201, 202
		206
Government subsidy	IV	237
McEvoy, report by, on geology and methods of mining	VII	500–504
Operations of	VII	502
Production 1899	III	187
1900	IV	293
CRUDE PETROLEUM AND ITS APPLICATION AS FUEL FOR INDUSTRIAL OPERATIONS IN THE HAWAIIAN ISLANDS Williams	VIII	59–67
Crucibles:		
Platinum first used for	VIII	193
Crushers:		
Blake	II	30
	IV	256
Carr revolving	IX	407
Challenge, Deloro mine, Ont.	IV	114
Comet	IV	223
Designing	II	28
Dodge, results with	IV	205 et seq
Faults of	II	31
Gale's	IV	205
Huntington mill	IV	205, 263
McCallum, notes by, on		30 et seq
Mother Lode mine, Boundary Dist., B.C.	VII	43
Scrantz mill	IV	263
Crushing:		
Asbestos	V	354
Copper Cliff, Ont	V	544
Corundum	V	168
Costs, classification	III	53
Deloro, Ont	IV	114, 119
Iron ore for concentration	VI	9, 11, 15, 18
	X	114
Magnetic separation	VII	280
Molybdenite ore	VI	52

* See Summaries, page 94

	Vol.	Page
Crushing—Con.:		
Mother Lode mine, Boundary Dist., B.C	v	215
	ix	346
Plant, Le Roi mine, Rossland	v	330
Pyrrhotite, cost of	vi	52
Slocan Dist., B.C	vi	153
S. Africa diamond mines, "Hard-blue ground"	v	75
Crushing rolls. *see* Rolls.		
Cryolite:		
Ivigtut, Greenland	vi	38
Crysotile:		
Structure	v	347
Crystal gold mine, WANAPITEI, NIP., ONT.	vii	122
Crystalline limestone: *see also* Limestone.		
Boundary Dist., B.C	v	515
Hastings Dist., Ont	v	240
Crystals:		
Calcite, Cobalt, Ont	x	70
Corundum	v	164
Cuprite, Boundary Dist., B.C	v	375
Mica	v	244
size of, Ontario	vii	162, 163
Peterborough, Ont	vii	305
Molybdenite	vi	47
Cuba:		
Asphalt deposits	vi	89
Iron mine	iv	25
ore exports to Canada 1900	v	566
Culbert, M. T.		
Paper on Cobalt ores by, referred to	x	19
Cumberland County, N.S.:		
Coal mining, 1901	v	582
report on conditions by FERGIE	vi	447
production 1902	vi	445
Copper	iv	311
	v	584
Cumberland, ENGLAND:		
Coal mining	ix	402–410
Cumberland Railway & Coal Co.:		
Production, 1901	v	583
Cummings Mt., CHIBOUGAMAU, QUE.:		
Asbestos on	ix	19
Cupellation:		
Oil assaying-furnace	v	289
Cuprite:		
King Solomon mine, Boundary Dist., B.C	v	375
Curie, Prof. P.:		
Quoted on radio-activity of Quebec cleveite	vii	251, 255
Curle, J. H.:		
Quoted on Yukon mining regulations	ix	123
Currie, J. A.:		
Discussion by on:		
The Status of the Mining Profession	x	332, 339
Min. ref	x	84
Curtis, Smith:		
Discussion by on:		
The Influence of Government on Mining	vi	371

	Vol.	Page
Custer County, Idaho, U.S.A.:		
Copper mining in	IX	54
Cuthbertson location, BRUCE MINES, ONT.	X	149
***CYANIDE TESTS ON TIMISKAMING ORES,** ROBERTSON	IX	396-401
Cyaniding: *see also* Bromo Cyanide Process, Gold, Metallurgy, etc.		
Crushing for	IV	190
Cyanide consumption	IX	396
Republic, Wash.	V	285
Discovery of	VI	27
Pelatin-Clerici process	V	274
PLUNKETT, paper by on	VII	192-193
Pulp, size of, influence	II	160
ROBERTSON, tests by on Timiskaming ores	IX	396-401
Athabasca mine, Nelson, B.C.	IV	85
Belmont mine, Ont.	V	241
	VII	241
Deloro mine, Ont.	IV	118 et seq
notes by CARTER	VII	123
Micmac mine, N.S.	VII	318
Mikado mine, Ont.	VII	134
Republic, Wash., notes by CIRKEL	V	177 et seq
Slocan Dist., silver ores	VII	200
costs	VII	204
Timiskaming, Ont., tests	IX	396-401
Cyanogen bromide:		
In bromo-cyanide process	IV	143
Solution of charge, in treatment of auriferous mispickel ores	IV	146
"Cyathophyllum":		
Boisdale Hills, C.B.	VI	426
"Cyclones": *see also* Crushing.		
Asbestos milling	V	354
Bell's asbestos mine	IV	7
Cylinder:		
Power drill, notes by HANSEN	V	489
Cymru copper claim, MOYRA SOUND, ALASKA	X	204
Cypress Hills, SASK. & ALTA.:		
Coal seams	X	235
Edmonton series	VIII	223
Geology of	X	235

D

Dakota, U.S.A.:		
Artesian wells in	VIII	84
Dakota formation (sandstone):		
Coal in, Southern Manitoba	VIII	242

See Summaries, page 126

	Vol.	Page
Dala River, *see under* Sweden.		
Dalecarlia Province, *see under* Sweden.		
Dalkeith Basin, LOTHIAN, SCOTLAND	VI	118
Dalton Tp., ONT.:		
Allanite	VII	254
Dam:		
Chicago drainage channel	III	36
Deer Lake, Peterborough Co., Ont	VI	236
Danaite:		
West Kootenay, B.C.	II	76
Dannemore, *see under* Sweden.		
Danville, QUE.:		
Asbestos	II	64
mines, notes by MOLLMAN	V	355
Darien gold mines, COLUMBIA, S. AMERICA:		
Notes by WOAKES	VI	142
Daru, N.D.:		
Discussion by on:		
The Education of Mining and Metallurgical Engineers	IX	164, 165
Davis, Carl R.	VII	58
Davis, Hon. E. J.:		
Address by	VII	267
Davis, George E.:		
On methods of generating chlorine	III	135
Davis calyx drill:		
Notes by DICKSON	IX	387
Davis Sulphur Ore Company	X	123
Davy safety lamps	VI	213
	IX	385
Effect of fire-damp on	V	379
Explosions resulting from	V	382
Dawson, Dr. Geo. M.:		
Appointment of to Directorship Geological Survey	IX	99
Cariboo Dist., report by on, referred to	X	418
Death of	IV	71, 288
	IX	100
Discussions by on:		
Description of the Sultana Quartz Lode, etc	II	241
The Gold Measures of Nova Scotia and Deep Mining	II	244
Elected Vice-President C. M. I. 1898	I	17
Map compilation, report by on, referred to	VI	318
Portrait of, presented to Survey	V	563
Quoted on formation, Texada Island	VIII	175
Reports on Crow's Nest Pass coal areas	IV	230, 234
Tribute to services of, by Blakemore	IV	230
Min. Ref.	IX	97, 98
	X	5, 218
Dawson, Sir William:		
On the Errian flora of Canada	II	187
Dawson, Y. T.:		
Cultivation of vegetables at	VI	324
Gold royalties 1900	IV	296
Notes by WADE	V	599
Day, Dr. David T.:		
Views, origin of petroleum	VI	94

	Vol.	Page
Dayton Creek, SLOCAN DIST., B.C.	v	12
Deadwood Camp, BOUNDARY DIST., B.C.:		
Copper deposits	v	174
De Beers diamond mines, S. AFRICA:		
Area	III	155
ABRAHAMS, paper by on occurrence and mining at	v	62–75
Operations	III	155
Debeque, Col., U.S.A.:		
Petroleum	VI	106
De Courtenay, H. W.	VII	10
Deer Lake, BELMONT, PETERBOROUGH CO., ONT.	VI	233
	VII	220
Deer Lake, MICH., U.S.A.:		
Charcoal consumption	II	46
Deer Park mine, ROSSLAND, B.C.:		
Vein	v	522
Deer Park Mt., ROSSLAND DIST., B.C.:		
Granite	v	519
Deidesheimer, Philip:		
Inventor of square set timbering	VI	129
DE KALB, COURTNEY:		
Discussion by on:		
Ontario corundum deposits	III	203
Papers by:		
**Adjustment and Control of the Stamp Mill*	II	149
†*The Duty of Stamp Mills in Crushing and Amalgamation*	IV	190–195
‡*More Notes on the Stamp Mill Practice*	IX	64–71
Dellwik-Fleischer water gas plant :		
Paper on by SJOSTEDT	VIII	296–301
Deloro gold mine, DELORO, HASTINGS CO., ONT.		
Auriferous mispickel treatment, paper by KIRKEGAARD	IV	112-122
WRIGHT	IV	143-151
CARTER, notes by on	VII	120
Pumping by compressed air at	v	265–273
Denbigh Tp., ADDINGTON CO., ONT.:		
Graphite mining in	VII	161
Denis, Theo. C.:		
Min Ref.	x	161
Denison Tp., SUDBURY DIST., ONT.:		
Geology of, notes by HIXON	IX	224
Gold and nickel discovered in	VII	499
Nickel discoveries in	VII	497
Platinum discoveries in	VII	165
Denudation: *see also* Erosion		
Boisdale Hills, C.B.	VI	414
Cape Breton, coal measures	IV	23
Copper Mt., Similkameen Dist., B.C.	v	494
Loon Creek Dist., Idaho	IX	56
Nova Scotia gold measures, effect of	IV	46, 47
Western Ontario	VI	329

* See Summaries, page 12

† " " 32

‡ See Summaries, page 112

	Vol.	Page
Department of the Interior: Publication of Canadian atlas by	VI	320
Department of Mines:		
BELL, B. T. A., views respecting	V	590–1
Establishment of in Canada:		
ADAMS, views on	V	589, 595
Advisability of, paper by LAMB	IX	87–106
TYRRELL, paper on	IX	107–11
Functions of:		
Notes by GWILLIM	V	139–140
HARDMAN	V	120 et seq
HUNGERFORD	V	136
LECKIE, R. G.	IX	21
MACDONALD	VI	350
MEISSNER	V	128
OBALSKI	V	155
SJOSTEDT	V	140
Resolutions of Institute respecting	V	589, 594
		597
	VII	34
DE PENCIER, H. P.:		
* ***Mine Timbering in the Old Ironsides and Knob Hill Mines***	V	424–446
Deroche Tp., ALGOMA:		
Iron in	VII	258
Des Plantes River, CHAUDIERE RIVER, QUE.	VIII	259
†***DESCRIPTION OF THE SULTANA QUARTZ LODE, AND THE SINKING OF THE BURLEY SHAFT IN BALD INDIAN BAY, LAKE OF THE WOODS.***		
SMITH, J. BURLEY	II	87
Discussion on by:		
ANDREWS, BELL, COSTE, FRASER, HARDMAN, INGALL, LATIMER, MACDONALD, SMITH	II	237–243
Deseronto, ONT.:		
Blast furnace at	II	59
	IV	267
	IV	302
	VII	155
Deseronto Iron Co.:		
Iron ore imports, 1900	V	566
Pig iron production, bounty paid on, 1900	IV	312
Desjardin farm, TILBURY OILFIELD, ONT.:		
Natural gas at	III	72
‡***DETERMINATION OF LEAD IN ORES BY FIRE ASSAY*** LAY	IV	224, 229
Determinations: *see* Analyses and Assaying.		
‡***DEVELOPMENT OF COARSE CONCENTRATION IN THE SLOCAN DISTRICT, B.C.,*** FOWLER	VI	146–160
Deville, C. St. C.		
Experiments by in manufacture of aluminium	III	137
Report by on Vesuvius eruption	VI	82
Devil's Head Creek, BANFF DIV., ALTA.:		
Coal discovery	VIII	233
Devonian:		
Characteristic fossils (illustration)	II	191
Elk River, E. Kootenay, B.C.	V	507
Graphite in	X	89

* See Summaries, page 55
† " " 8
‡ See Summaries, page 33
‡ " " 62

	Vol.	Page
Devonian—Con.:		
Nanticoke, Pa	IX	375
Oil and gas horizons in	III	81, 82
Ontario, South Western	III	78
Tilbury	X	81
Western	II	187
Deyell, Harold J.	VII	334
Diabase:		
Atlin Dist., B.C.	V	21
Cobalt Dist.	X	64
relation to ores	X	49, 50
Ingram Tp., Ont.	X	69
Lake Mistassini, Que.	IX	19
Lardeau Dist., B.C.	VII	90
Pense Tp., Ont.	X	69
Poplar Creek Dist., B.C.	VII	104, 106
Rossland Dist., B.C.	V	520
Texada Island, B.C.	X	244
Diabase-porphyrite:		
Texada Island, B.C.	VIII	176
Diagrams:		
Air compression curves	VIII	286
pump	VII	529
Anthracite breaker (cross section)	IX	264 (opp.)
(longitudinal section)	IX	264 (opp.)
Atomizer for crude petroleum	VIII	62 (opp.)
Cableway towers	IV	132 (opp.)
Coal-breaker, Bankhead, Alta.	IX	256 (opp.)
Dellwik-Fleisher water gas plant	VIII	294
Emery slate picker	IX	266
Electric furnaces:		
Heroult	VIII	146 (opp.)
Keller	VIII	139
Kjellin	VIII	145
Stassano	VIII	151
Grondal ball mill	X	266
Haulage plant, Wabana iron mine	III	132 (opp.)
Heaters	VII	510, 513, 516, 519, 522, 524, 526
Iron concentrating mill	X	113
Kingsley lead process	VIII	253, 254
Matte separator	IX	61, 62
Method of preparing anthracite coal	IX	264 (opp.)
Nickel refining process	V	208, 209
Oil attachments on locomotives	VIII	64
furnace	V	293–295
Roasting plant, horizontal section	VII	483
vertical section	VII	484
Diamond Drilling: *see under* Drilling.		
Diamonds: *see under* Precious Stones.		
"Diamond" system of coal mining	IV	129
Dick, Alex.:		
Discussion by, on:		
The Small Economies of Mining	III	170
Dick, W. J.		
The Cariboo Consolidated Hydraulic Plant, Bullion, B.C.	X	418–425

* See Summaries, page 148

	Vol.	Page
Dickey, R.	x	200
Dickinson, Joseph	ii	18
DICKSON, DR. CHARLES W.		
Discussion by on:		
The Ore Deposits and Geology of the Sudbury District	ix	228, 230-3
Papers by:		
**The Distribution of Platinum Metals in other Sources than Placers*	viii	20, 192–210
†*Genetic Relation of Nickel-Copper ores*	ix	236–260
Min. Ref.	viii	210–212
	x	277, 278
Dickson, Dr. Geo. A:		
Min. Ref.	ix	222
DICKSON, WALLACE		
‡*Prospecting Drills*	ix	387–395
Dies:		
Types of	ix	67
Diesel motor	ii	167
Dikes: *see* Dykes.		
Dillsboro, Jackson County, N. Carolina	ix	303
Dimock, Clarence H.:		
Elected Councillor, C.M.I., 1898	i	18
Dinorwic, Rainy River Div., Ont.:		
Pyrite at	x	125
Diopside:		
Associated with copper	x	254
Diorite:		
Atlin Dist., B.C.	v	21
Boundary Dist., B.C.	v	514
Chibougamou, Que	viii	363
Frontenac, Co., Ont.	vii	211
Greenwater Lake, Ont.	v	52
Hastings Dist., Ont.	v	240
Lake Abitibi, Ont.	vii	243
Lardeau Dist., B.C.	vii	89
Sudbury Dist., Ont.	v	529
Diorite-porphyrite:		
Boundary Dist., B.C.	v	366
Dip:		
Iron ore beds, Wabana, Newfoundland	iv	63
Dipper Dredge, *see also* Dredging:		
Cost of operating	iii	33
Notes on by Clarke	v	90
Dirt Hill, Moose Jaw Div., Sask.:		
Coal at	x	235, 237
"Discovery":		
Condition of title to mineral lands, Ontario	iii	114
Discovery Creek, Atlin Dist., B.C.:		
Gold-bearing gravel, notes on by Gwillim	v	23 et seq.
Discovery Passage, Vancouver Island, B.C.:		
Formation	vi	195
¶*DISTRIBUTION OF PLATINUM METALS IN OTHER SOURCES THAN PLACERS, THE.* Dickson	viii	20, 192–210
Discussion by Dickson, Goodwin, Evans, Gibson, Walker, Barlow, Ingall, Coste, Read	viii	210–214

* See Summaries, page 100
† " " 120
‡ See Summaries, page 126
¶ " " 100

	Vol.	Page
Ditton, COMPTON CO., QUE.:		
Formation at	VII	399
Dividends:		
Le Roi mine, Rossland, B.C.	V	311
New Zealand, gold dredging	IV	298
Dock Bay, QUEBEC:		
Iron sands	IV	95
Dodge crusher	IV	205, 208
Results with, notes on by PORTER	IV	208, 214, 218, 220, 221–223
Dog River, PAINT LAKE, ONT.:		
Magnetite	IV	281
Dolcoath mine, CORNWALL, ENG.:		
Tinstone	IV	214
Dolliver Mountain, UPPER SEAL HARBOUR DIST., N.S.:		
Gold mining	V	584
Dolomite: *see also* Limestone.		
Boisdale Hills, C.B., analyses	VI	431
Composition	IV	152
George River series, C.B.	VI	423, 431
Nastapoka Island, Hudson Bay	V	256
"Dome Gneiss"	VII	286
Dominion Basin, TELKWA RIVER, B.C.:		
Self-fluxing ores of	X	222
Dominion of Canada Plumbago Mining Co.	X	91
Dominion claim, DOMINION BASIN, SKEENA RIVER DIV., B.C.	X	221
Dominion Coal Co., SYDNEY, N.S.:		
Blasting experiments	I	9
Coal cutting	VI	446
Description of collieries	IV	27–30
Operations 1900	IV	310
Production 1833-1900	IV	22
1901	V	582, 583
Shipping pier, description	IV	15
Dominion Copper Co., BOUNDARY DIST., B.C.:		
Smelter returns	V	374
Dominion Creek, Y.T.:	III	124
Gold royalties 1900	IV	296
Dominion Government: *see also* Canadian Government.		
Action of, respecting petroleum	X	80
Assay Office:		
DONALD'S views	V	150
Need for	V	132, 136, 138
Vancouver, B.C.	V	151
Well's views	V	577
Dredging leases, revenue from	V	577
Educational institutions	V	145
Grants to Institute	II	29
	VII	199
Dominion Institute of Federated Engineers	IV	73
Dominion Iron & Steel Co., SYDNEY, N.S.	VI	314
Capital	III	194
Coal consumption	III	188
plant	IV	11
Description of works	X	377
Dolomite properties of	VI	431

	Vol.	Page
Dominion Iron and Steel Co., SYDNEY, N.S.—Con.:		
Establishment of	III	120
Iron ore imports 1900	V	565
Operations	IV	11
1900	IV	311
Plant	IV	12, 13
	X	377
Production 1901	V	583
Steel manufacture at, practice	X	373
Sulphuric acid manufacture by	VI	392
Wabana iron mine, acquisition	III	131
	VI	66
Dominion mineral claim, POPLAR CREEK DIST., B.C.	VII	101
Dominion Mineral Co., SUDBURY, ONT.:		
Blezard Tp., Ont.	III	225
Organization of	VII	499
Worthington nickel mine	III	225
Dominion No. 1 colliery, CAPE BRETON:		
Description	IV	27
Dominion No. 2 colliery, CAPE BRETON:		
Description	IV	278
Dominion No. 3 colliery, CAPE BRETON:		
Description	IV	29
Dominion No. 4 colliery, CAPE BRETON:		
Description	IV	29
Domnarfvet: *see under* Sweden.		
DONALD, DR. J. T.:		
Discussion by on:		
The National Importance of Mining	V	150
Papers by:		
**Composition of some Canadian Limestones*	IV	152–4
†A Notable Canadian Deposit of Chromite	II	25–26
‡Notes on the Limestone of the Philipsburg Railway and Quarry Co.	V	47–48
Webster nickel ores assayed by	IX	308
Minor Ref.	VII	82
Donaldson Lake, LABELLE CO., QUE.:		
Graphite near	X	91
Donkin, Hiram:		
Address by at Sydney Meeting of Institute	IV	30
Donnelly, John:		
Secretary, Eastern Ontario Branch	X	606
Min. ref.	VII	415
Dorchester, N.B.:		
Copper mining	V	582
Dorion Tp., THUNDER BAY DIST., ONT.:		
Lead and zinc occurrences in	VII	155
DOUGLAS, DR. JAMES:		
Addresses by:		
Cape Breton	IV	54
Institute excursion, 1900	IV	31, 36
Sherbrooke, Que.	IV	6
Sydney, C.B.	IV	13, 17
Appreciative reference to for services to mineral industry	II	213

* See Summaries, page 30 ‡ See Summaries, page 39
† " " 4

	Vol.	Page
DOUGLAS, DR. JAMES—Con.		
Discussions by, on:		
The Education of Mining and Metallurgical Engineers	IX	160, 165, 167
The Gold Measures of Nova Scotia and Deep Mining	II	250
The National Importance of Mining	V	151–153
The Sampling of Argentiferous and Auriferous Copper	II	226, 227
Notes by, on:		
Early recollections of Quebec	IV	9
Iron industry in Canada	II	213
possibility of hydraulic mining, Chaudiere Valley, Que.	IV	9
Swedish iron industry	II	213–216
Papers by:		
**The Use of Wood Gas in the Manufacture of Iron and Steel*	V	178–182
†Swedish Iron Metallurgy and its Application to Canada	II	38
Min. ref.	VII	400
	IX	21, 24
Douglas coal seam, NANAIMO DIST., V.I.	VI	196
Douglas County, OREGON:		
Nickel deposits of	IV	185
Douglas fir:		
Boundary Dist., B.C.	V	426
Dow, Wm. & Co.	VIII	93
Dowagiag, MICH., U.S.A.:		
Diamonds discovered at	III	153
DOWLING, D. B.:		
Discussion by on:		
The Life History of Coal Seams	VIII	241
Papers by:		
‡The Coals and Coalfields of Alberta, Saskatchewan and Manitoba	X	229–241
¶Notes on the Utilization of Poor Coals and Slack	IX	321–327
‖The Stratigraphy of the Cascade Coal Basin	VIII	221–233
Drainage:		
Coal Creek colliery system	IV	166
Drainage Channel:		
Chicago, Ill., excavation of	III	33
Drainage Tiles: *see also* Tiles.		
Ontario production, 1900	IV	304
Drake, Frank	VII	356
Drammen: *see under* Norway.		
Dredges and Dredging: *see also under* Gold.		
Buckets	V	92
Chicago drainage channel, cost per cu. yd.	III	33
Hydraulic	III	34
Iron sands, cost of	VII	274
Prospecting, paper by ROBINSON	VI	214–223
Saskatchewan river, Sask. types	V	517
Stewart river	VI	469

* See Summaries, page 45
† " " 5
‡ " " 140
¶ See Summaries, page 124
‖ " " 102

	Vol.	Page
Dredges and Dredging—Con.:		
Vermilion river, Ont., for gold	VII	117
Yukon, leases	V	576
DRESSER, John A.:		
Discussion by on:		
The Artesian and Other Deep Wells on the Island of Montreal	VIII	97
Bornite ores of B.C. and Yukon	VIII	182
Elected Councillor (1907)	X	17
Papers by:		
**The Bed-Rock of the Gilbert River Gold Fields, Quebec*	VIII	259–262
†*On the Copper-Bearing Volcanic Rocks in the Eastern Townships of the Province of Quebec*	V	81–86
‡*A new area of copper-bearing rocks in the Eastern Townships of the Province of Quebec*	VII	397–399
¶*Note on Varieties of Serpentine in South-Eastern Quebec*	VIII	267–269
Quoted on rocks of Sheffield Mt., Que.	IX	213
Min. ref.	VIII	263, 264, 265, 269
Drewry, J. C.:		
Views on a Canadian Dept. of Mines	V	592
Drifting:		
Centre Star mine, Rossland, B.C., methods	V	458
Notes by Forrest	VI.	2
Driftwood Bend, BELLY RIVER, ALTA.:		
Coal at	X	234
Driftwood Creek, SKEENA DIV., B.C.:		
Coal analysis	X	224
discovery	X	223
Drill(s):		
Calyx	V	133
Carriages used in Simplon tunnel	II	140
Cost of repairing, LeRoi mine, Rossland	V	410
Cores:		
Examination of for geological purposes	II	189
Sampling	V	454
Diamond:		
Bits, corundum for	VI	5
size of, mica mines	VII	297
Canadian trade in 1900	IV	315
Invention of	VI	23
Largest core made with	IX	389
for Oil wells	II	208, 211
Setter, wages of	IX	389
Special work of	IX	389
Electric	II	166, 172
motor for	II	180
PARLEE, notes by, on	VI	377
Percussive	II	174
Rotary	II	176
Sharpening, costs	VII	365

* See Summaries, page 104
† " " 41
‡ See Summaries, page 86
¶ " " 104

	Vol.	Page
Drill(s)—Con.:		
Siemens & Halske	II	172, 173, 176
Solenoid	II	172
Types, paper by HANSEN	V	484–492
Drilling, *see also* boring.		
Animikie iron range	VI	251
Atikokan Dist., result of	IX	298, 300
Brayton Domain collieries, Eng	IX	402
Chicago Drainage Channel, costs	III	35
Cumberland County, N.S., coal	V	583
Diamond:		
drillers, wages of	IX	389
gas and oil wells	II	210, 211
government records, need for	V	131
iron ore deposits, prospecting for, by	II	68
KEFFER, paper by, on	IX	317–20
Kitchener, B.C.	V	77
Knob Hill, Ironsides mine, Phoenix, B.C.	V	367, 518
Matawin River, Ont., iron ore	V	52
New South Wales, by Government	V	136
Rossland Dist., B.C.	V	453
tabulating progress and costs of	IX	319
DICKSON, paper by, on	IX	387
Electric, of coal	II	182
Electricity vs. air	II	176
Engines, Rossland Dist, B.C.	V	454
FORREST, notes by, on	VI	2
HANSEN, notes by, on	V	492
LeRoi mine, Rossland, B.C.	V	410
Mica mines, Ontario	VII	297
Minnesota iron mines, notes on	VII	362
Mother Lode mine, Boundary Dist., B.C.	V	215
	IX	340
Ober Gruna mine, Freiberg	II	174
Oil wells	II	208
Ontario iron ranges, notes by WILLMOTT	VII	264
PARLEE, paper by	VI	376
Petroleum	II	189
Regent iron mines, Mich.	VII	322
Rossland Dist., B.C., miners' wages	V	479
Salzburg mine, Germany	II	177, 178, 181
Simplon tunnel, Switzerland	II	140
Torbrook iron dist.	IX	33
DRUMMOND, GEORGE D.:		
****The Uses of Chemical Analysis in Iron Blast Furnace Practice and some notes on Laboratory Methods***	X	442–462
DRUMMOND, GEORGE E.:		
Discussions by, on:		
The Modern Blast Furnace Laboratory	VI	472
Swedish Iron Metallurgy and its Application to Canada	II	217
Elected Councillor, C.M.I. 1898	I	18

---

* See Summaries, page 149

	Vol.	Page
DRUMMOND, GEORGE E.—Con.:		
Papers by:		
**The Iron Industry in 1898*	II	57
† *1899*	III	118–123
Resolution on compilation of mining statistics	II	255
Min. ref	I	17
	VIII	9
Drummond, John J.:		
On Swedish iron metallurgy	II	222
Min. ref	VI	300
Drummond, J. N.	VIII	94
Drummond, T. J.:		
Views on Quebec Mining Bureau	VI	481
Drummond Colliery, WESTVILLE, N.S.:		
Mine pumping	III	128
Drummondville, ROXTON, QUE.:		
Copper at	VIII	182
Pig iron from	IV	305
"Dry ore":		
Definition	V	10
Slocan, B.C., freight and treatment charges on	V	13
‡***DRY ORES OF THE SLOCAN, B.C., THE.*** CAMPBELL-JOHNSTON	V	10–14
"Dry Well":		
Definition of	VIII	87
Dryden, Ont.:		
Iron pyrites at	VII	158
Duchess claims, TELKWA RIVER, B.C	X	222
Duck Mts., MANITOBA:		
Coal seams	VIII	242
Ducktown, TENNESSEE, U.S.A.:		
Copper occurrence	IX	40
	X	251
Pyrite deposit	X	119
Secondary enrichment	V	298
Dudswell Tp., WOLFE COUNTY, QUE.:		
Gold bearing gravels of	VIII	259
Rocks in	VII	399
Dufferin gold mine, SALMON RIVER DIST., HALIFAX CO., NOVA SCOTIA	II	54
Commencement of operations	II	249
Development	II	126
Stamp mill mortar, description	II	102
Duggan, G. Herrick:		
Elected vice-president, 1906	IX	26
Du Loup River, CHAUDIERE RIVER, QUE.	VIII	259
Dumble, E. T.:		
On the Santa Clara coalfield, Sonoro, Mexico	VIII	240
Views on "oil phenomena" of Texas	VI	103, 104
Dumping-tippler:		
Coal Creek colliery	IV	162
Dun Mt., NEW ZEALAND:		
Dunite	IX	312
Dunbrack gold mines, OLDHAM, N.S.	X	426
Duncan River, LARDEAU DIST., B.C	VII	93

* See Summaries, page 6
† " " 21
‡ See Summaries, page 37

	Vol.	Page
Dunite:		
Webster, N. Carolina	IX	304, 312
Dunnington, Prof. P. F.:		
Ref. to analyses of Webster nickel ores	IX	304
Dunnville, HALDIMAND CO., ONT.:		
Natural gas	VII	427
Dunsmuir, Hon. Robt.:		
Coal mining operations by	VI	188
Dunstan, Wyndham:		
Report by on Canadian mica	IV	306 et seq.
Duperry, Madame	X	346
Du Toits Pan diamond mine, S. AFRICA	V	62
Area	III	155
Character of rock	III	155
***DUTY OF STAMP MILLS IN CRUSHING AND AMALGAMATION.** DEKALB	IV	190–195
Dyeing:		
Bichromates in	IX	37
Great Britain, industry	V	148
Dykes:		
Animikie iron range	VI	253
Ascot belt, Eastern Tps., Que.	V	84
Athabasca mine, Nelson, B.C.	V	15
Atikokan, Ont.	V	56
gabbro	IX	285
notes by HILLE	IX	291, 297
Auriferous	II	84
Belmont gold mine, Ont.	VII	216
Boundary Dist., B.C.	V	173
	V	366, 370
King Solomon claim	V	375
Mother Lode mine	V	213, 515
	VII	42
Bruce Mines, Ont.	X	159
Butte, Mont.	V	297
Copper Mt., Similkameen Dist., B.C.	V	498
Effect of solfataric action	II	84
Enrichment from	V	373
Franklin Camp, B.C.	X	172
as Guides to prospecting	II	84
Helen iron mine, Michipicoten	VII	206
Josie mine, Rossland, B.C.	V	404
Leadville, Col., U.S.A.	II	86
Long Island, Boisdale Hills, C.B.	VI	420
Mercur, Col., U.S.A.	II	86
Nova Scotia gold areas	II	119
	II	248
S. E. British Columbia, Notes by KIRBY	V	508
Slocan Dist., B.C.	VI	148
Telkwa River, B.C.	X	225
Texada Island, B.C.	X	243, 247
Thunder Bay, Ont., in Animiki slate	III	160
Pegmatite, origin of	VII	288
Pontgibaud, Auvergne	II	85
Rossland Dist., B.C.	V	520, 523
notes by KIRBY	VII	49
Salmon River Dist.	III	6
Tulameen Dist., B.C., peridotite	VIII	220

* See Summaries, page 32

	Vol.	Page
Dykes—Con.:		
West Kootenay, B.C.	II	75
relation to mineral deposits	II	76, 83
	III	141
Western Ontario, notes by BRENT	VI	328
Ymir mine, B.C.	III	6
	V	525
Dyment, LAKE OF THE WOODS, ONT.:		
Gold mining near	VII	138
Dynamite:		
Introduction of in mining	VI	23
Freezing point	II	244
Thawing	II	243
	V	338
Dynamo:		
Coal Creek colliery, B.C.	IV	171
Direct or alternating current for	II	169
When first made	III	134

E

Eagle, Wisconsin:		
Discovery of diamonds at	III	151
Eagle Lake, RAINY RIVER DIST., ONT.:		
Gold ores	VI	331
EARLY HISTORY OF MINING IN THE SUDBURY DISTRICT, THE, EVANS	VII	495–499
Earth:		
Age of	X	301
Density of	VI	125
	X	304
Sub-stratum	VI	102
Earth movements:		
Notes by MILLS	VII	177
Earthquakes:		
HIXON, notes by	X	308
New Caledonia	VI	171
East Broughton, Que.:		
Asbestos production 1900	IV	305
East End Silver Mountain mine, THUNDER BAY, ONT.:	VII	141
East Howle colliery, DURHAM, ENGLAND:		
Heating of feed water at	VII	508

* See Summaries, page 90

	Vol.	Page
East Kootenay, B.C., *see under* Kootenay.		
East Main River, QUE.	VIII	363
East Ridge fault, BUTTE, MONTANA:	V	298
East Waverley Mine, HALIFAX, N.S., *see* Waverley mine.		
***EASTERN ONTARIO, A REGION OF VARIED MINING INDUSTRIES,** MILLER	V	233–255
Eastern Tps., QUE.:		
Asbestos mining in, notes on	IV	7, 8
Auriferous Cambrian resemble Nova Scotia gold measures	II	119
Branch of Institute, organization	V	607
Chromite	IV	208
occurrences	IX	35–38
Copper	II	62
bearing rocks of, paper by DRESSER	V	81–86
	IX	397–399
pyrites	V	570
LOGAN, work of, in	X	345
Nickel in serpentine rocks of	IX	315
Placer gold deposits, formation	VIII	259
Serpentines, notes by HUNT	VI	169, 170
varieties of	VIII	267–269
Eastern Townships Chrome Iron Mining & Milling Co.	II	26
†***ECONOMIC GEOGRAPHY,** WHITE	VI	317–326
Discussion by: COSTE, FERGIE, GOODWIN, LECKIE, WHITE	VI	467–468
Economic geology and resources, *see also* Economic Minerals, Geology, Mineral Resources, etc.		
Belmont Tp., Ont., gold ores, notes by KNIGHT	VII	211
Boisdale Hills, C.B., notes by BORIGHT	VI	429–434
Boundary Dist., B.C., paper by Brock	V	365–378
Butte, Montana	V	297
Cobalt Dist., Ont.	X	45–53
Conrad Mining Division	X	211
Copper Mt., Similkameen Dist., B.C.	V	498
Eastern Ontario	V	233–255
Goldfield, Nevada	VIII	40
HARDMAN, notes by on	V	117
Lardeau Dist., B.C.	VII	109
Loon Creek Dist., Idaho	IX	54
Mt. Sicker Dist., V.I., B.C.	VI	194
Nickel deposits:		
St. Stephen	IX	236
Sohland	IX	253
Webster	IX	310
Rocky Mts., silver-lead deposits	V	514
Rossland Dist., B.C.	V	448, 520, et seq.
notes by Kirby	VII	48
Skeena River, paper by Leach	X	218–228
Slocan Dist., B.C.	VI	148
Texada Island, B.C.	X	244
WALKER, notes by	VII	435
Windy Arm, Y.T.	IX	49

* See Summaries, page 48
† " " 69

	Vol.	Page
Economic minerals:		
New Caledonia	VI	170
Ontario exhibit, Buffalo Exhibition	V	252
Vancouver Island, B.C.	V	228–232
***ECONOMICAL TREATMENT OF SULPHIDE ORES,** JACKES.	VIII	244–258
Economy:		
As applied to mining; definition	III	14, 170
Edison iron mines, NEW JERSEY, U.S.A.:		
Magnetic concentration	VI	17
Edison separator:		
Notes on by Wells	VI	17
Edmonton, Alta.:		
Coal: fuel ratio	X	236
geology	VII	423
mining	V	108
1902 report by F. B. Smith	VI	374
seams	X	235
supply	V	112
Edmonton series, *see also* Laramie.		
Fuel ratios of coals in	X	236
Northern Alberta	VIII	223
Quality of coal found in	X	230, 234, 236
Turtle Mt., Manitoba	VIII	223
Education:		
GOODWIN, views of on scientific	V	144 et seq
†***EDUCATION OF MINING AND METALLURGICAL ENGINEERS, THE,** PORTER	IX	143–179
Educational Institutions:		
Established by Dominion Govt.	V	145
EDWARDS, W. H.		
‡***Notes on the Production and Uses of Canadian Chrome***	IX	35–38
EDWARDS, W. MUIR:		
¶***Concentration of Argentiferous Galena as carried on at Helena Frisco Consolidated Company's Mills, Gem, Idaho, U.S.A.***	IV	254–264
Edwards, W. S.:		
On gold mining in California	IV	47
Effingham Tp., LENNOX CO., ONT.:		
Mica occurrence	VII	289
Egan Tp., OTTAWA CO., QUE.:		
Molybdenite	VI	49
Egg Creek, near Victoria, Alta.:		
Coal at	X	237
"Eight-hour law":		
British Columbia, application to mines	III	168
Discussion on, by Institute	III	168, 170-173
Resolution of Institute against	III	172

* See Summaries, page 103
† " " 116
‡ See Summaries, page 109
¶ " " 35

	Vol.	Page
Elbow River, MOOSE MT., ALTA.:		
Coal, hardness,	X	232
seam	X	232
Eldorado creek, KLONDIKE, Y.T	III	124, 210
Gold mining	V	575
El Dorado gold mine, EAGLE LAKE, RAINY RIVER DIST., ONT	VI	332
Eldridge, Geo. H.:		
Views on origin of Grahamite	VI	104
Eleanor Lake, NIPISSING DIST., ONT.:		
Iron ore deposit	IV	280
Electric battery:		
Generating chlorine by means of	III	135–136
Electric drill: *see* Drills	II	172
Electric drilling: *see also* Drilling.		
Coal	II	182
Electric furnaces:		
Charging	VIII	140
Description of	VIII	136
Evans	IX	128
Héroult	III	137
Linings for	IX	131
Electric hoist:		
War Eagle mine, Rossland, B.C.	V	464
Electric light:		
Costs of	VIII	300
Electric locomotive:		
Jeffrey, in coal mines	IV	238
Electric motor:		
Coal Creek colliery, specifications	IV	170
Electric power, *see also* Power.		
Cost, sampling mill	V	336
Plant, Coal Creek colliery, East Kootenay, B.C.	IV	237
Electric pump, *see also* Pumps.		
Tripley, Coal Creek colliery ,B.C.	IV	239
Electric pumping	III	147
Electric smelting:		
Aluminium	III	137
Cost	III	138
HAANEL, paper by	VIII	132–154
Discussion on, by:		
COSTE, KIRKPATRICK, MILLS, STANSFIELD	VIII	154-161
Iron, notes on, by:		
BENNIE	X	172
BIRKINBINE	X	144
STANSFIELD	X	129
Iron sands, notes on, by:		
OBALSKI	VII	278
SNYDER	VII	274, 282
Nickel, Sudbury, Ont	III	136
Sault Ste. Marie, Ont	III	139
Steel, ppaper by EVANS	IX	128-142
Zinc, aper by SNYDER	VIII	119-131

	Vol.	Page
***ELECTRIC SMELTING,** HAANEL	VIII	132–154
†***ELECTRIC SMELTING OF ZINC ORES, THE** SNYDER	VIII	119–131
Electric traction:		
Pioneer Iron mine, Minn.	VII	348
‡***ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES,** HILLE	II	166–185
Electrical Reduction Co., BUCKINGHAM, QUE.	IV	308
Ferro-chrome	V	571
Electricity:		
Air compressing by, paper by THOMPSON	VI	180–187
in coal mines, danger of	V	392
vs. Air for drilling	II	176
Bankhead colliery, Alta	VIII	219
Diesel petroleum motor	II	169
Effect of on assaying balance	VI	471
FARADAY'S discoveries	III	133
History	III	133
LeRoi mine, Rossland, B.C.	III	164
Measuring	VIII	148
for Mine haulage plants	II	185
in Mines	VI	449
Steel manufacture by	VIII	146
Zinc smelting	VIII	129
Electro-chemistry:		
History	III	133
Recent advances in, paper by GOODWIN	III	133–140
Electro-chemical industry:		
In Canada, opportunities for, GOODWIN'S views	V	147
In United States	V	147
Electrodes:		
Consumption of, electric smelting	VIII	143
Electro-metallurgy, *see also* Electric smelting.		
Molybdenite	VI	61
Nickel-copper, paper by KOEHLER	V	189–212, 396 et seq.
notes by ULKE	V	393
Recent advances in, paper by GOODWIN	III	133–140
Electrolysis:		
Chloride solution	V	397, 399
Corrosive effect of	VIII	51
Faure patent	V	204
KOEHLER, notes by	V	189 et seq.
Manufacture of chemicals by	III	134
Phosphorus, manufacture	III	139
Potassium chloride	III	136
Sulphate solution	V	397, 399
Trickett & Noad patent	V	204
ULKE, notes by, on	V	393
¶***ELECTROLYTIC PRODUCTION OF METALS, WITH SPECIAL REFERENCE TO COPPER AND NICKEL,** KOEHLER	V	189–212
Discussion by KOEHLER	V	393–402
ULKE	V	393–402
	VI	336

* See Summaries, page 97
† " " 97
‡ See Summaries, page 13
¶ " " 46

	Vol.	Page
Electrolytic refining:		
Body's process	v	195, 196
Copper, Siemens & Halske process	v	198
Hoepfner process	v	199
KOEHLER, notes by, on	v	19 et 2 seq.
Marchese process	v	194, 210
Nickel:		
Andree process	v	204
Basse & Selve process	v	205
Farmer process	v	204
KOEHLER, notes by	v	192 et seq.
ULKE, notes by	v	393 et seq.
process	v	394
Electroscope:		
Inexpensive form of	VII	254
***ELECTROTHERMIC PRODUCTION OF STEEL FROM IRON ORE, THE,** STANSFIELD	X	129–133
Elk River coalfield, EAST KOOTENAY, B.C., *see also* Crowsnest Pass.		
Coal hardness	X	232
seams	VII	502
	X	230, 232
Extent	IV	231
Formation	V	507
Fuel ratios	X	230, 232
Limestone outcrops	IV	231
Shales, bituminous	IV	233
cretaceous	IV	231
Elkington copper refining process:		
Description	V	193
Ellamar copper claim, PRINCE WILLIAMS SOUND, ALASKA	IX	45
	X	202
Ells, Dr. R. W.:		
Geology of Eastern Tps., Que., notes on, by	V	84
Quoted on origin of pyroxenite	VII	293
Elmore oil process:		
Concentrator, Massey Station, Ont	VII	145
Molybdenite	VI	54
Rossland Dist., B.C.	VII	68
Min ref	VII	185
Ely, Minnesota, U.S.A.		
Iron mining near	VII	334
†***EMMA MINE, THE,** KEFFER	X	188–194
Emma mine, BOUNDARY DIST., B.C.:		
Ore deposit	V	368
Emerald Lake, TIMAGAMI DIST., ONT.:		
Jaspilyte	IV	278
Emery slate picker:		
Diagram of	IX	265
Emmens, Dr. Stephen H.:		
Quoted on Webster nickel deposits	IX	305

* See Summaries, page 133
† " " 137

	Vol.	Page
Emmons, S. F.:		
Quoted on the relation of dykes to ore bodies	II	85
zones of enrichment, Butte and Arizona	V	378
Views on secondary enrichment, Butte, Montana	V	298
Enargite:		
Butte, Montana	X	253
Engineering:		
Legislation affecting	V	561
Engine(s):		
Dredge	VI	222
at Loading station, Port Morien, C.B.	IV	131
Nagle	IV	171
Polson	IV	167, 171, 238
Ventilating fan	IV	107 et seq.
Enrichment:		
Copper Mt., Similkameen Dist., B.C.	V	502
Rossland Dist., B.C.	V	523
Enterprise mine, SLOCAN DIST., B.C.	V	11
	VII	375
Concentrator, notes by FOWLER	VI	152, 155
Veins	V	12
Eocene:		
Terrigenous sediments	VI	89
Epidote:		
Boundary Dist., B.C.	V	369
Gaspé, Que.	VII	399
Pacific Coast copper deposits	X	207
Erin mine, SLOCAN DIST., B.C.	V	11
Ernst, George:		
Concentrating tests on molybdenite by	VI	57
Erosion, *see also* Glaciation.		
Bilbao Dist., Spain	IV	202
Butte, Mont.	X	253
Cascade Coal Basin, Alta.	VIII	224, 228
Hawaiian Islands	VII	70
Rocky Mts.	IV	232
	VII	501 et seq.
Pictou Co., N.S., Westville strata	V	362
Rossland, B.C.	V	523
Telkwa River, Skeena Div., B.C.	X	225
West Kootenay, B.C.	II	77
Errington, Joseph:		
Discussion by on The Stewart River gold dredge	VI	470
Ertelien nickel mines, Norway	VII	406
Eruptive dykes, *see also* Dykes:		
Boundary Dist., B.C.	V	371
Eruptive rocks:		
Boundary Dist., B.C.	V	365 et seq.
Emma mine, analysis	X	188
Platinum in	VIII	198
Esmaralda County, NEVADA, U.S.A.:		
Gold in	VIII	39
Esperanza iron mine, TRIANO DIST., SPAIN	IV	200
Esquimalt & Nanaimo R'y. Co.:		
Land grant	VI	197

	Vol.	Page
Essex County, ONT.:		
Natural gas	III	68, 82,
	VI	103
	VII	427
Oil horizon in	VII	175
***ESTABLISHMENT OF SCIENCE CLASSES,** HOLDICH	II	21
Estevan, ALTA.:		
Coal mining	V	108
Estevan Mt., SOURIS, SASK.:		
Geology	VII	423
Estremadrua Province, *see under* Spain.		
Euphemia, LAMBTON CO., ONT.:		
Oil and natural gas	III	82
Eureka, NEV., U.S.A.:		
Basalt	V	496
Mineralization, result of expiring vulcanism	II	85
Eureka, WEST VIRGINIA, U.S.A.	VI	105
Eustis, QUE.:		
Formation at	VIII	260
Pyrite	IV	208, 222
Eustis copper mine, CAPELTON, QUE.	V	82
	VI	391
Gold in ores of	VIII	262, 264, 265
Notes by LECKIE	VII	400
Eustis Mining Co., EUSTIS, QUE.:		
Pyrites	IV	308
Eva gold mine, FISH RIVER, LARDEAU, B.C.:		
Mineralization at, notes by BROCK	VII	95
EVANS, J. W.:		
Discussion by, on:		
The Distribution of Platinum Metals in other sources than Placers	VIII	210
Electric smelting experiments of	X	129, 130
Papers by:		
†*The Early History of Mining in the Sudbury District*	VII	495–499
‡*The Gold-Bearing Sands of the Vermilion River*	II	105
¶*Some Laboratory Experiments in Making Steel Directly from Iron Ores with the Electric Furnace*	IX	128–142
Evans calcining furnace	VI	306
Evans Gold Dredging Co.	IV	297
Evans nickel mine, SUDBURY DIST., ONT.	V	528
	VII	497
Ores of	VII	498
Evening claims, TELKWA RIVER, B.C.	X	222
Evening Star mine, ROSSLAND, B.C.:		
Production, 1894-1904	VII	47
Evening Star No. 8 mine, SLOCAN DIST., B.C.	V	11
Vein	V	12

* See Summaries, page 4
† " " 90
‡ See Summaries, page 9
¶ " " 116

	Vol.	Page
Evje, *see under* Norway.		
Evje Nickel Co., NORWAY	VIII	208
Excavation(s):		
Chicago drainage channel	III	33
Graders and scrapers, efficiency and costs of operation	III	34
Excavator:		
Hover and Mason's, description	III	34
Exchange mine, SLOCAN DIST., B.C.	V	11
Excursions of Institute, *see under* Canadian Mining Institute.		
***EXHAUST STEAM BOILER FEED WATER HEATERS,**		
HARDIE	VII	505–530
Exploration:		
LeRoi mine, Rossland, B.C., costs	V	340
Marquette's, of Lake Michigan	III	32
Rocky Mts., Canada:		
Notes by Macdonald on organizing	VI	345
†***EXPLORATION OF THE ONTARIO IRON RANGES,***		
WILLMOTT	VII	257–265
Explosion(s), *see also* Accidents, Colliery explosions, etc.		
from Acetylene gas	II	229, 230
Air cylinders, cause	V	160
ASHWORTH, paper by	V	379–392
BLAKEMORE, notes by	VI	200 et seq.
Coal dust	VI	204
Fergie, views on	VI	450
Electricity, danger of in coal mines	V	391 et seq.
Fire-damp	V	381, 384
and coal dust mixture	V	380, 383, 385
Safety lamps	VI	207
Vacuum resulting from condensation	VI	206
Explosives:		
Centre Star mine, Rossland, B.C.	V	458
Coal Creek colliery, B.C.	IV	160
"Compressed Cartridge" composition	I	4
Experiments with, at Caledonia colliery	I	7, 8
Dominion colliery	I	9
Substitutes for, in coal mines	I	3–4
Thawing dynamite, device for	II	243
Use of, in artesian wells	VIII	100
Exports from Canada:		
Agricultural, 1896-1904	IX	105
Graphite	X	99
Export duty:		
Canadian nickel	III	226
Extension, VANCOUVER ISLAND, B.C.:		
Coal mines	VI	195
"Extra-lateral rights":		
Butte, Montana	V	299
Eyre, F. J.	VII	497

* See Summaries, page 92 † See Summaries, page 81

F

	Vol.	Page
***FACTORS IN CONCENTRATION, THE,** Snyder	III	102–109
FAIRLIE, M. F.:		
†*Mining and Concentration of Corundum in Ontario*	V	164–170
Fairview Dist., B.C.:		
Faults	II	145
Free milling gold ores in	II	142
Geology	II	146
Mineralization	II	144
Oro Fino mill	II	36
Famine River, Chaudiere River, Que	VIII	259
Fan-heater:		
LeRoi mine, Rossland	V	328
Fans:		
Belt driven	IV	110
Capell	V	109
Chandler	IV	239
Changing velocity	IV	111
at Coal Creek colliery	IV	164
Direct driven, disadvantages of, for large installations	IV	108
Engines, Nagle, Coal Creek colliery	IV	171
Guibal	IX	380
Murphy	IV	239
	V	110
Peacock, paper on by	IV	107–112
Power for driving	IV	111
Rope driven	IV	110
Waddle	IX	409
Faraday:		
Electrical discoveries of	III	133
FARIBAULT, E. R.:		
‡*On the Gold Measures of Nova Scotia and Deep Mining*	II	119
Discussion	II	247
Report by on Nova Scotia gold measures	IX	99
Farmer electrolytic refining process:		
Nickel	V	204
"Fault-fissures":		
Nova Scotia gold measures	II	124

* See Summaries, page 20
† " " 44
‡ See Summaries, page 10

	Vol.	Page
Faults:		
Athabasca mine, Nelson, B.C.	v	15
Butte, Montana, paper by BRADEN	v	296–301
Cascade & Bow Valleys, Alta	viii	223
Crowsnest Pass coal area, B.C.	iv	231
East Ridge, Silver Bow Valley, Montana	v	298
Essex County, Ont., established by drilling	vi	103
Fairview Camp, B.C.	ii	145
Hammond Reef mine, Ont.	viii	188, 190
Lethbridge coalfield, Alta.	v	106
Mt. Skerrit, V.I., B.C.	vi	194
Nanaimo Dist., V.I.	vi	196
in Oil and gas fields.	iii	74
Pentland, Scotland	vi	79
Pictou coalfields, N.S.	v	358
Rossland Dist., B. C., notes by KIRBY	vii	51
Rundle and Cascade Mts., Alta.	viii	232
Slocan Star mine, Sandon, B.C.	v	510
Telkwa River coalfields, B.C.	x	225
West Kootenay, B.C.	iii	141
Faure electrolytic process	v	204
Fauresmith, S. AFRICA:		
Diamantiferous formation	vi	79
Federated Canadian Mining Institute:		
Dissolution of	ii	197
Organization of	vii	28
Feed water heaters, *see* Water Heaters.		
Feldspar:		
Bedford, Ont., analysis	v	247
Frontenac Co., Ont	vii	388
Industry in Eastern Ont., notes by MILLER	v	246, 247
Quebec, 1898	ii	343
Statistics:		
Canada, 1901	v	572
1902	vi	454
1906	x	12
Ontario, 1902	vi	464
1903	vii	392, 426, 430
Quebec, 1898	ii	343
1899	iii	187
1900	v	353
Uses	v	251
FELL, E. NELSON:		
**Notes to accompany one plan and three Vertical Sections of the Athabasca mine, on Toad Mountain, near Nelson, British Columbia*	v	15–20
†*Notes on Gold Milling Practice at the Athabasca mine, Nelson, B.C.*	iv	83–90
Felsite:		
Boisdale Hills, C.B.	vi	414
Rainy River Dist., Ont	vi	328, 331
Slocan Dist., B.C., Dykes	vi	148
Vancouver Island, B.C.	vi	192

* See Summaries, page 37
† " " " 24

	Vol.	Page
Fennell Creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11
FERGIE, CHAS.:		
Addresses by:		
on Cape Breton Excursion 1900	IV	38
as President (1903)	VI	444 et seq.
at Sydney meeting of Institute	IV	32
Welcome to American Institute of Mining Engineers	IV	16
Discussion by, on:		
Mining Pumps	III	197, 198
Elected President of Institute	IV	77
1902	V	603
Vice-President 1898	I	17
On the C.S.C.E. Bill, restricting engineering practice	II	256
Paper by:		
**Results in the Use of a Rotary Pump as against Straight Line Type*	III	128–129
Vote of thanks to	VI	480
Min. refs.	VI	455, 467, 477, 484
	VIII	18
Ferguson, Angus:		
Report on the effect of coal dust on safety lamps	VI	202
Ferguson, LARDEAU DIST., B.C.	VII	87
Mining at	VII	97
Ferguson mineral claim, SEINE RIVER, RAINY RIV. DIST., ONT.	VI	332
Fergusonite:		
Berthier County, Que.	IX	72
Fern mine, HALL CREEK, NELSON DIV., B.C.	III	3
Fernie, B.C.:		
Coal, fuel ratio of	X	230, 232
Coke ovens at	IV	241
Establishment of town of	IV	241
Limestone at	IV	170
No. 2 Colliery, cause of explosion at	V	379, 382
	VI	201, 202, 206
Fernie, William:		
Biography	IV	231
Crowsnest Pass coalfields discovered by	IV	230
Elected Director, Crow's Nest Pass Coal Co	IV	230
Ferrier, Hon. James	X	150
Ferrier, W. F.:		
Corundum in Ontario discovered by	VII	413
Mineral collection of, Toronto University	VIII	71
Views on:		
The Geology of Rossland District	III	163
The Occurrence of Corundum in Ontario	III	200
Secondary enrichment in Rossland Dist., B.C.	V	523
Ferro-chrome:		
Manufacture, Buckingham, Que.	IV	308
	V	571
Ref.	IX	35

* See Summaries, page 22

	Vol.	Page
Ferro-manganese:		
Hillsboro, New Brunswick	IV	309
Manufacture	VII	276
Bridgeville, N.S.	III	188
rail steel	X	394
Ferro-molybdenum:		
Price and use	VI	63
Ferro-nickel:		
New Caledonia, ores	VI	178
production	VI	485
Ferrona, N.S.:		
Blast furnace	IV	35
Coke ovens, capacity of	IV	35
Iron deposit	IV	35
Ferronia iron mines, NEW YORK, U.S.A.:		
Magnetic concentration	VI	16
****A FEW FEATURES OF MINING IN THE REGENT GROUP OF MINES, NEGAUNEE, MICH.,*** ATKINSON	VII	319–334
Discussion by MICKLE, DEYELL	VII	334
†***A FEW SUGGESTIONS ON MINERAL STATISTICS,*** COSTE	VI	408–410
Fieldskuldnaes, *see under* Norway.		
Fielding, Hon. W. S.:		
Address by at Halifax meeting of Institute	IV	57–59
Filter-press:		
For lixiviation plant	IV	124
Republic Reduction Works, Wash.	V	285
Filtering:		
Of feed water in boilers	VII	509
Finland:		
Economic atlas of	VI	321
Fire assay, *see also* Assays.		
Lead	IV	224 et seq.
Fire-damp:		
see also Coal Mines, Colliery explosions, explosions, gases, etc.		
Danger of, in dusty mines	VI	205
Detection of	V	391
	VI	205
with safety lamps, percentage	VI	209–212
Effect of on gauze lamps of Davy type	V	379
Explosive qualities of, when mixed with coal-dust	V	380
	VI	202
Hydro-carbons in	VI	202
Pictou and Cumberland County collieries	VI	447
Susquehanna coal mine, Pa.	IX	385
in Ventilating current	V	389
Volume of air required to dilute	IV	163
Wilkes-Barre colliery, Pa., percentage of in fan-drift	VI	203
Fire Lode, BRUCE MINES, ONT.	X	151
Fire protection:		
LeRoi mine, Rossland, system of	V	338
MACDONALD, notes by	V	342

* See Summaries, page 84
† " " 73

	Vol.	Page
Fischer, Ferdinand:		
On improvements in the electrolytic manufacture of chemicals	III	134
Fish River, LARDEAU DIST., B.C.	VII	87, 93
Ores of	VII	93
Fisher Maiden mine, SLOCAN DIST., B.C.	V	11
Fisheries:		
British Columbia statistics 1901	VI	357, 362
1906	X	187
Fissure veins:		
Albertite	VI	475
Asbestos in	V	351
Bridge River Dist., B.C.	III	25
Butte, Montana	V	297
Fairview Camp, B.C.	II	146
Kongsberg silver mines, Norway	VII	401
Open-fault, not usually important mineral producers	II	80
Produced by faulting	VIII	190
Rainy River Dist., Ont.	VI	332
Replacement, effect of	V	521
Rossland Dist., B.C.	V	403, 451
notes by KIRBY	VIII	50 et seq.
St. Eugene mine, Moyie, B.C.	V	511
Slocan Star mine, Sandon, B.C.	V	509
Tonopah, Nevada	VIII	45
Vancouver Island, notes by BREWER	VI	193
Ymir mine, Ymir, B.C.	V	525
Fissures:		
Gases from	VI	83
Fitzgerald & Bennie Laboratories, NIAGARA FALLS, ONT.:		
Iron concentration tests at	X	270
FitzJames, Count de:		
Report by on Mt. Pelee eruption	VI	80
Fitzroy mineral springs, CARLETON CO., ONT.	VIII	91
Five Mile, LARDEAU DIST., B.C.:		
Concentrating mill at	VII	99
Flagstone:		
Production, Quebec, 1900	V	350
Flaherty, R. H.:		
Drilling for iron by, Rainy River Dist., Ont.	VII	158
Fletcher, Hugh, Sr.	X	168
Flint, W. G.:		
Notes by on crushing and sizing	IV	205–223
Flint Lake min. claim, FLINT LAKE, RAINY RIVER DIST., ONT.:	VI	332
Flora:		
Cretaceous period	X	229
Florence gold claim, GOLDFIELD, NEVADA	VIII	39
Flow-sheet:		
Frisco concentrator, Gem, Idaho	IV	258
Flue dust:		
Copper Cliff, Ont., analysis	V	546
Greenwood smelter, B.C.	IX	357
Magnetic concentration of	X	263
Treatment of	X	75

	Vol.	Page
Flume:		
Belmont mine, Ont.	VI	236
Cost of maintaining	VI	159
Fluxes:		
Assaying	V	42
of lead	IV	225, 228
Boundary Dist., B.C., notes by KEFFER	V	45
pyrrhotite, for	X	189
Dolomite, Boisdale Hills, C.B.	VI	431
Foeoe island *see under* Norway.		
Folding:		
Bendigo, Australia	II	121
Nova Scotia:		
Amplitude of	II	121
Extent	II	126
Gold measures	II	120
Foley, James:		
Death of	IV	288
Foley mineral claim, SEINE RIVER, RAINY RIVER DIST., ONT.	VI	332
Fondon silver process:	VII	200
Foot-hills, ROCKY MTS.:		
Coal, character of	V	106
FORBES, H. L.:		
†***The Chlorination of Gold Ore of the North Brookfield Mine, Nova Scotia***	VII	308–318
Ford Pit coal seam, PICTOU, N.S.:		
Thickness	VI	447
Fore-hearth:		
Notes on by HEDLEY	IX	59
Forests:		
Charcoal yield per acre	II	47
Fires, effect of, Sudbury Dist., Ont.	VII	495
Reserves owned by Kopparberg Co., Sweden	II	42
Forest Hill Dist., N.S.:		
Gold quartz veins	II	248
Forestry:		
Association with iron industry	II	215
Conservation	II	52
in Sweden	II	218
conservation, methods of	II	47
relation to mining	II	45
Forging:		
Water gas in	VIII	297
FORREST, B. J.:		
‡***Mine Development Methods***	VI	1–5
Forster, J. B.	X	437
Fort Steele Mining Division, B.C.:		
Nickel	III	225
Ore deposits, notes by CORLESS	V	508, 511
Forth River, SCOTLAND:		
Formation	VI	78

* See Summaries, page 83
† " " 58

	Vol.	Page
Forty Thieves mineral claims, BRIDGE RIVER DIST., B.C.	III	23, 28
Horizontal extension of vein	III	26
Fossils:		
Albert Co., N.B.	VI	475
Boisdale Hills, C.B	VI	416, 417, 425–428
Carboniferous, Pictou Co., N.S.	V	362
Collecting for museum	VIII	70
Cretaceous:		
Cascade coal basin, Alta	VIII	233
Devonian	II	191
Distribution of, to schools	VII	436
in Kettle Point shales	II	186
Logan's interest in	X	362
Niagara group, Western Ontario	II	210
"Protosalvinia Huronensis"	II	187, 189
Foundations (for stamp mills)	IX	65
Fouque:		
Quoted on volcanic emanations	VI	83
Four entry system of coal mining	V	108
Four Mile Creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11
Fourche, INDIAN TERRITORY, U.S.A.	VI	105
FOWLER, S. S.:		
Discussion by on:		
The Small Economies of Mining,	III	170
Elected Chairman, B. C. Branch of Institute	VI	440
Elected President of Institute 1900-1	III	217, 218
Papers by:		
**Development of Coarse Concentration in the Slocan District, B.C.*	VI	146–160
†*Notes on the Ymir mine and its Mill Practice*	III	3–10
Min. ref.	VI	438
Foyers, *see under* Scotland.		
Fraleck, E. L.:		
Discussions by on:		
A Mineral containing Radium in the Province of Quebec	VII	254
The Occurrences, Production and Uses of Mica	VII	304, 306
Some Gold Deposits in Eastern Ontario	VII	243
France:		
Auvergne, bitumen	VI	86
Coal production 1850-1900	VI	31
Joint stock companies in	IV	245
Iron production 1899	III	120
reserves	X	141
and steel production 1807-1900	VI	29
La Praz:		
Electric smelting at	VIII	147
Livet:		
Electric smelting at	VIII	139

* See Summaries, page 62
† " " 14

	Vol.	Page
Frances iron mine, MICHIPICOTEN, ONT.:		
Notes by WILLMOTT	VII	260, 261, 262, 265
Francois:		
Charcoal experiments of	II	46
Francois Lake, SKEENA RIVER DIST., B.C.:		
Volcanic rocks at	X	220
Frank coalfields, ALTA:		
Geology	VII	422
Mines	V	108
	VI	374
Frank, H. L.:		
Coal mining operations of, Blairmore, Alta	V	578
Frank & Gebo:		
Coal mine, Blairmore, Alta	VI	232
Franklin Camp, B.C.:		
Geology and ore deposits, paper by BROCK	X	170
Franklin Creek, KETTLE RIVER, B.C.	X	173
Franklin Jr. copper mine, MICH., U.S.A.:		
Production costs at	X	415
Franklinite:		
Magnetic permeability of	VI	11
Frasch nickel-refining process	IV	301
	V	205
Fraser, A. W.:		
Discussions by, on:		
The Mining Laws of Ontario	III	204
The Sultana Quartz Lode, etc	II	242
Fraser, D. C.:		
Address by at meeting of Institute, Cape Breton (1900)	IV	37, 38
Fraser, Graham:		
On Cape Breton iron and steel industry	IV	26
Elected Councillor 1904	VII	22
Elected Vice-President of Institute 1902	V	603
Fraser River, B.C.:		
Gold dredging	V	88 et seq.
Fraser River Dredging Co.	V	91
Free-milling gold ores, *see also* Gold.		
Fairview, B.C.	II	142
Lake of the Woods Dist., Ont.	VII	124–139
Nelson Dist., B.C.	V	525
Western Ontario	VI	330
Freiberg School of Mines:		
Note on by MILLER	VI	21
Freibergite, *see also* Silver.		
Windy Arm, Y.T.	IX	51
Freight rates, *see also* Transportation.		
Crowsnest Pass, on coke	IV	170
Minnesota iron ores	IV	282
Ores:		
Lardeau Dist., B.C.	VII	101
Rossland Dist.,	V	311, 314, 316, 318, 334
Slocan Dist., B.C.	V	13

	Vol.	Page
French Bar Bluff, QUESNELLE, B.C.	X	419
French River, JAMES BAY, ONT.:		
Gypsum on	VII	166
Freymuth, W. A.	VII	207
Friction:		
On wire rope	V	38
Friction clutch:		
Steam hoist	V	462
Frontenac, Count de	IX	4
Frontenac Co., ONT.:		
Galena ores	VII	143
Graphite mining	VII	161
Mica occurrences	V	244
	VII	289
Frood, Thomas	VII	496, 498
Frue, Capt.:		
Manager, Silver Islet mine	VII	141
Frue vanners:		
Athabasca mill, Nelson, B.C.	IV	85
Cariboo mine, Camp McKinney, B.C.	II	144
Deloro mill, Ont.	IV	117
Helena Frisco mill, Idaho	IV	260
Invention of	VII	141
Fuels:		
see also Coal, Coke, Natural Gas, Lignite, Oil, Peat, etc.		
for Blast Furnaces:		
Coke per ton of ore	VIII	125
economy of	II	217
losses in	VIII	120, 121
Canmore, Alta., coal on C.P.R. locomotives	V	109
Coal slack in furnaces	IX	326
Coke	IV	137
Coke-oven gases, in steel manufacture, costs	IV	11, 12
Consumption:		
air compressing plant	VI	185
Domestic:		
coal, coke, gas, relative values	IV	135 et seq.
peat for	VII	394
Gas:		
composition	IV	137
in reverberatory furnace	IX	327
Lignite, efficiency of, notes by DOWLING	IX	321 et seq.
Oil, for assaying furnaces	V	288
Peat:		
for domestic	VII	394
smelting	IX	328
Petroleum	VIII	59
costs of	VIII	66
Railways, Western Canada, paper by BLAKEMORE	VI	224 et seq.
Statistical notes on, by JOHNSON	VI	70

	Vol.	Page
Fuel ratio:		
Coal, list of Laramie and Edmonton	X	236
Kootanie measures	X	230 et seq.
Fumarole:		
Note by COSTE	VI	84
Fumes:		
Arsenic, antidote	V	241
Furnace(s): *see also* Blast Furnaces.		
Assaying and melting, paper by BRENT	V	288–295
Calcining, notes by SORENSEN	VI	306–316
Calculating charge for	X	291
Coal slack as fuel for	IX	326
Copper Cliff, Ont.	V	546
Cormack Spirek roasting oven	II	16
Daily records of	X	281
Deloro, Ont	IV	150
Domestic, coke for	IV	141
Gas calcining	II	50
Graphic record of consumption and output	X	292
Granza	II	14
Heat radiated from	VIII	126
Midland, Ont.	X	449
Northport, Wash.	V	332
Plattsburg, U.S.A.	II	50
Roasting	VII	482
Siemen-Martin	II	41
Types of open-hearth	X	376
Furnace gas(es), *see also* Gas.		
Chemical energy lost in	VIII	124
Furnace lining:		
Chromite ores for	IX	37
FURTHER OBSERVATIONS RELATIVE TO THE OCCURRENCE OF DEPOSITS OF COPPER ORE ON THE NORTH PACIFIC COAST AND ADJACENT ISLANDS, FROM THE SOUTHERN BOUNDARY OF BRITISH COLUMBIA TO THE ALASKAN PENINSULA, BREWER.	X	195–208
†***FUTURE OF THE COAL AND COKE SUPPLY OF BRITISH COLUMBIA,*** BLAKEMORE	VI	224–232

G

Gabbro:		
Atikokan, Ont.	IX	285, 290
map	IX	296 (opp.)
Belmont gold mine, Ont.	VII	215
Mesaba iron range	VI	251
Platinum in	VIII	201

* See Summaries, page 137
† " " 65

	Vol.	Page
Gabbro—Con.		
Rossland Dist., B.C.	V	449, 519
	VII	48
Sudbury Dist., Ont	V	235, 529
Windy Arm, Y.T.	IX	50
Gabbro-diorite:		
Kitchener, B.C.	V	76
Gabbro-porphyrite(s):		
Lardeau Dist., B.C.	VII	89
Gainer Creek, LARDEAU DIST., B.C.:		
Formation at	VII	92
Gale, Judge	X	367
Galena: *see also* Lead and Silver.		
Attraction of, for oil	VII	187
Argentiferous, concentration of	IV	254–264
Crushing	IV	208, 210, 220
Kingsley process of testing	VIII	246
Magnetic separation of	V	8
British Columbia:		
Ainsworth, B.C.	V	509
Atlin Dist	III	100
Boundary Dist.	V	368
in calcite gangue	V	516
Cariboo Dist	VI	325
Fish River, Lardeau Dist	VII	93, 96, 97, 98
Fort Steele Dist.	V	509
Franklin Camp	X	173
Kimberley, North Star mine	V	512
Kootenay, East, Windermere Dist.	III	185
West	II	76
Omineca Dist.	X	228
Poplar Creek Dist.	VII	105, 106
Rossland Dist.	V	452, 522
Slocan Dist.:		
notes by FOWLER	VI	146–149
sorting	VI	155
Vancouver Island, San Juan	V	231
Ymir mine	III	8
milling	III	9
Cape Breton:		
Boisdale Hills	VI	414
Ontario:		
Dorien Tps.	VII	155
Ores of	VII	374
Rainy River Dist.	VI	333
Sault Ste. Marie	VII	142
Shipments of	III	170
Sultana mine	II	238
Quebec:		
Operations	II	63
Production, 1900	V	350
Shipments of	III	170
Yukon:		
Conrad Mining Division	X	211
Windy Arm	IX	51, 52

	Vol.	Page
Gale's grinder	IV	205
Galicia:		
Bitumen occurrence	VI	77
Oilfields	IX	101, 108
Gallagher, W. H.:		
Resolution by on the establishment of a Canadian mint	II	257
Gallivare: *see under* Sweden.		
Gallow, James:		
Notes by GARDE	VI	305
Galloway, Prof.:		
Report on Universal Colliery explosion	VI	202
Gallowscrook, *see under* Scotland.		
Galway Tp., PETERBOROUGH CO., ONT.:		
Allanite	VII	254
Pyrrhotite	VII	395
Gananoque River, LEEDS CO., ONT.:		
Iron industry	IV	266
Gangue:		
Knob-Hill-Ironsides mine, Phoenix, B.C.	V	518
Rocky Mts., silver-lead deposits	V	514
Slocan Dist., B.C., minerals	VI	148
Slocan Star mine	V	509
Ganong, W. K. and A. D.	IX	238
Garcia, Don Wenceslao	VIII	275
GARDE, A. C.:		
Discussions by on:		
Canadian Metallurgical Products for the Far East	VIII	161
The Life History of Coal Seams	VIII	242–243
The Value of an Undeveloped Mining Claim	VIII	118
Papers by:		
**Notes on the British Columbia Zinc Problem*.	VII	368–373
†Notes on Machinery constituting a Mining Plant	VI	301–305
Minor refs.	VI	440
	VIII	10, 159, 335
Gardner Canal, GRIBBEL ISLAND, B.C.:		
Copper prospecting near	IX	41
Garneau, George	IX	24
Garnet:		
Boundary Dist., B.C.	V	369
Emma mine	X	189, 190
Magnetic separation of	VI	14
Pacific Coast copper deposits	X	207
Parry Sound, Ont.	VIII	181
Texada Island, B.C.	VIII	176
Marble Bay mine	X	247
Yerington, Nev., U.S.A.	X	258
Zones:		
Notes by Kemp	X	254
Garnetite:		
Whitehorse, Y.T.	VIII	177
Garnier, Jules:		
Garnierite discovered by	VI	173
Garnierite	IX	306
New Caledonia, analyses	VI	173

* See Summaries, page 84 † See Summaries, page 67

	Vol.	Page
Garthby, Que.:		
Copper deposit	V	82
Gas, *see also* Natural Gas, Fuels, etc.		
Acetylene as a mine illuminant	II	227–229
from Air-treated peat	IX	327
Analyses	V	180, 181
Boyle's law respecting	IX	303
Calorific power of	IV	138
Carbonic acid, ill effects from leaking stove pipes	IV	142
from Coal:		
Bituminous, recovery of	IV	138
	VIII	239
Compared with water	VIII	299
Generating	V	178
	IX	325
Process employed for testing	IX	321
Combustion	IX	138
Detection of in coal mines	V	392
	VI	203
Explosions, *see also* Colliery explosions.		
in coal mines, paper by ASHWORTH	V	379–392
Effect of temperature and barometric pressure	V	392
	VI	205
Furnace	VIII	124, 125
Graham's law of the diffusion of	IV	141
Heat producing	IX	325
Lake Superior plant, production costs	VIII	295
Lava	VI	82
from Lignite, cost of producing	IX	325
Ljunberg kiln	II	51
Mt. Pelee eruption	VI	80
from Petroleum	VIII	60, 61
Relative value of coals in producing	IX	323
Sulphuric acid manufacture	VI	394
Sydney, C. B., coke-oven production and utilization	IV	11
Tar from	IX	326
Testing:		
Brayton Domain colliery, Eng	IX	404
"Cap" heights	VI	210
Process employed for	VI	200
	IX	321
Report on by ASHWORTH	VI	210
Transportation of	IX	326
Uses of in iron working	VIII	296
Volcanic:		
Analyses	VI	83
Composition	VI	84
from Waste materials	II	50
Water and coal compared	VIII	299
Westman's calcining furnace	II	50
Wood, use of in iron and steel manufacture	V	178–182
Gas burners:		
Bondsept, description	IV	138
Bunsen	IV	139
Gas engine:		
Efficiency of	VIII	124
Mixed gases	V	181

	Vol.	Page
Gas furnace:		
Roasting	VII	486
Westman's calcining	II	50
Gas Inspection Act:		
Provisions of	X	78
Gas mantle:		
Composition	VI	43
Gas producers:		
Anthracite, with lignite, use of	IX	324
Cost of installing	IX	330
Efficiency in relation to fuel consumption	IX	321
Fuel for, notes by SNYDER	VIII	120, 121
Isolation of	IX	326
Lignite, tests with	IX	322
Gas tar:		
Lignite, in gas producer	IX	324
Gas testing appliances:		
Ashworth-Hepplewhite-Gray lamp	V	390
	VI	200, 203, 213
Chesneau alcohol lamp	VI	212
Claw's hydrogen flame	VI	203
Davy lamp	IX	404
Pieter lamp	VI	203
Shaw's appliance	VI	203
Stoke's safety lamp	VI	206
Gaspe, Que.:		
Drilling for oil at	II	209
Logan, work in	X	357
Oilfields of	IV	309
Petroleum	II	64
	III	187
Rocks of	VII	399
Gaspereaux, N.B.:		
Molybdenite	VI	48
Gay-Lussac tower:		
Sulphuric acid manufacturing	VI	393, 396, 399, 403, 404
Gaya district, *see under* Bengal, *under* India.		
"Geflossene" structure:		
Animikie iron range	VI	253
Gem, IDAHO, U.S.A.:		
Concentration of galena at	IV	254
Gems, *see* precious stones.		
General Electric Co., SCHENECTADY, N.Y.:		
Mica mines in Ontario	VII	297
General Mining Association:		
Nova Scotia	IV	23, 210
North Sydney, sale of coal mine	IV	35
General Mining Association of Quebec:		
Affiliation with Institute	II	198
Organization of	VII	27
Generators:		
Loomis-Pettibone	V	178
Nacozari	V	180

	Vol.	Page
Genesee formation:		
Western Ontario	II	185, 189, 190
**GENESIS OF THE ANIMIKIE IRON RANGE* HILLE	VI	245–287
†*GENESIS OF THE COPPER DEPOSITS OF YERINGTON, NEV., THE,* JENNINGS	X	257–260
‡*GENETIC RELATIONS OF NICKEL-COPPER ORES,* DICKSON	IX	236–260
Genoa, *see under* Italy.		
Genth, Dr. F. A.:		
Quoted on minerals of North Carolina	III	151
"nickel-gymnite"	IX	306
Genthite:		
Analyses	IX	307
BARLOW, notes by	IX	306
Geodetic Survey:		
Canada, notes by White	VI	468
Geographer:		
Functions of, notes by WHITE	VI	325
Geography:		
Definition of, by MILL	VI	317
Economic, paper by WHITE	VI	317–326
South-eastern British Columbia	V	505
Geological maps: *see also* Maps.		
Copper Mt., Similkameen Dist., B.C.	V	495, 497
Crow's Nest Pass coalfields, B.C.	IV	240 (opp.)
Rossland Dist., B.C.	V	504
Vizcaya & Santander Provinces, Spain	IV	196
Geological sections:		
Atikokan, Ont.	IX	296 (opp.)
Bilbao iron deposits, Spain	IV	199
Blairmore Dist., Alta.	VII	423
Boisdale Hills, C.B.	VI	417, 418, 419, 420, 422, 433
Bruce mines, Ont.	X	159
Butte, Montana	V	302–308
Coal Creek colliery, B.C.	IV	159
Ely, Minn., Pioneer iron mine	VII	337–339
Goat Creek, Skeena River, B.C.	X	226
Kimberley diamond mine, S. Africa	V	63
Lacey mica mine, Ont.	VII	292, 294
Lost Packer Lode, Idaho	IX	54
Nevada goldfield	VIII	42
Pictou coalfield, N.S.	V	360, 361, 363
Pine-Spruce valley, Atlin Dist., B.C.	V	25
Porcupine Creek, Lardeau Dist.	VII	94
Port Arthur, Ont., iron deposits	V	56
Sudbury Dist., Copper Cliff mine, Ont.	V	532
Victoria mines, Ont.	IX	224 (opp.)
Geological students, *see under* Students.		
¶*GEOLOGICAL SURVEY OF CANADA AS AN EDUCATIONAL INSTITUTION, THE,* WALKER	VII	435–442

* See Summaries, page 66
† " " 143
‡ See Summaries, page 120
¶ See Summaries, page 89

	Vol.	Page
Geological Survey(s), *see also* Canadian Geological Survey.		
Canada:		
As an Educational Institution, paper by WALKER	VII	435–438
Discussion on by:		
ADAMS, BARLOW, BROCK, BROWN, CLARK, COSTE, CRAIG, GIBSON, LECKIE, MONTGOMERY, PARKS	VII	438–449
History of	IX	87
Logan's views on object of	IX	91
Maps, notes by Adams	V	585
Records of borings	II	209, 210
Scope and sub-division of, notes by HARDMAN	V	116
notes by MEISSNER	II	70
Staff, inadequate salaries of	IX	21
Value of economic work	II	247
in North America, note by BIRKINBINE	X	138
Geological surveying:		
Topographical work combined with, paper by BELL	VIII	56–58
Geologists:		
Training of	VII	437, 439, 440, 441
Geology, *see also under* Metals, Minerals, Ore deposits, etc.		
Value of in mining, notes by HARDMAN	V	117
Western Canada, coal measures	VII	500 et seq.
Alberta:		
Cascade Coal Basin, paper by DOWLING	VIII	221–233
Coalfields	V	104–107
	VII	422 et seq.
British Columbia:		
Atlin Dist	III	205
	V	22 et seq.
Boundary Dist	V	365, 514
notes by LEDOUX	V	172
Bridge River Dist	III	24
Columbia River basin	V	505
Copper Mt., Similkameen Dist	V	493
Crowsnest Pass coalfield	IV	156, 231
	VII	502
Eastern	VII	422
Fairview Camp	II	146
Franklin Camp, paper by BROCK	X	170–179
Lardeau Dist	VII	88 et seq.
Nelson, Athabasca mine	V	15 et seq.
Poplar Creek Dist	VII	103
Rossland Dist	II	74
	III	163
	V	403, 519
notes by CAMPBELL	V	448 et seq.
notes by Kirby	VII	48
Salmon River Dist	III	4
Skeena River coalfield	X	227
Slocan Dist	II	73
	VI	148
Telkwa River coalfield	X	225
Texada Island	VIII	175
Vancouver Island, notes by BREWER	VI	189
West Kootenay	II	73

	Vol.	Page
Geology—Con.:		
Newfoundland:		
Bell Island	II	67
Wabana	IV	63
Nova Scotia:		
Boisdale Hills, paper by BORIGHT	VI	411–434
Gold measures	II	120
	IV	46
Joggins, Bay of Fundy	VI	447
Pictou coalfield	V	358 et seq.
Ontario:		
Animikie iron range	VI	254 et seq.
Atikokan	IX	287
Bruce Mines, Ont	X	157
Cobalt Dist., paper by BELL	X	62–68
Corundum deposits	III	200
Eastern, gold belt	VII	211
Iron ranges	VII	257
James Bay	III	196
Keweenaw Peninsula	X	399
Lake Timagami region	III	192
Larder Lake Dist., notes by PARKS	X	69
Natural gas fields	III	69
Nipissing Dist	IV	275
Sudbury Dist	V	235
paper by HIXON	IX	223–227
Thunder Bay Div	VIII	183
Sultana Lode	II	88
Tilbury oil and gas fields	X	81
Welland Co	III	75
Western	II	208
	VI	327
notes by HILLE	V	50 et seq.
oil fields	II	186
Quebec:		
Chibougamau Dist	IX	19
Eastern Tps	V	81 et seq.
Saskatchewan:		
Coalfields	V	104–107
South Africa:		
Kimberley diamond field	III	155
Spain:		
Somorrostro Dist	IV	198
United States:		
Butte, Mont	V	297 et seq.
Douglas County, Oregon, nickel deposits	IV	186
Goldfield, Nev., notes by JENNINGS	VIII	40
Nanticoke, Luzerne Co., Pa	IX	375–386
Webster, N. Carolina	IX	310
Yukon:		
Conrad Mining Div	X	211
Klondike	III	216
paper by MCCONNELL	III	124–127
Windy Arm	IX	49
GEOLOGY AND ORE DEPOSITS OF FRANKLIN CAMP, B.C., THE. BROCK	X	170–179

* See Summaries, page 135

	Vol.	Page
George River, BOISDALE HILLS, C.B.:		
Limestone	IV	11
Georgia, U.S.A.:		
Corundum concentration	V	166
Mica	VII	287
Georgia mineral claim, ROSSLAND, DIST., B.C.:		
Nickel at	VII	67
Georgian Bay, LAKE HURON, ONT.:		
Copper-gold ores at	VIII	265
Notes by MILLS	VII	178
Georgian Bay canal:		
Proposed construction of	IV	279
Georgian Bay Islands	VII	178
Gerard, LARDEAU DIST., B.C.	VII	87
Germany:		
Chemical manufacturing industry	V	147
Coal production, 1850-1900	VI	31
Copper consumption	VI	34
Electric drilling	II	182
Gold production, 1885-1900	VI	25
Government grants to universities	V	146
Graphite statistics	X	101, 102
Indigo manufacture	V	145
Iron:		
industry, notes by MILLER	VI	281
production, 1899	III	120
reserves	X	141, 146
and Steel production, 1807-1900	VI	39
Joint stock companies in	IV	245
Pyrite deposits:		
Bodenmais	X	119
Meggen	X	119
Rammelsberg	X	119
Technical education	V	146
Universities:		
Berlin, state aid to	V	146
Bonn, state aid to	V	146
Gottingen, establishment	V	147
Gersdorfitte:		
Sudbury Dist., Ont	V	235
Worthington mine	V	536
West Kootenay, B.C.	II	76
Gertrude nickel mine, SUDBURY DIST., ONT.	IV	301
Minerals in ores of	X	276
Geysers:		
Note by COSTE	VI	85
Origin of, notes by HIXON	X	301
G. H. claim, FRANKLIN CAMP, B.C.	X	174
Giant mine, ROSSLAND, B.C.:		
Molybdenite	VI	48
Production of, 1894-1904	VII	47
Gibson, Thos. W.:		
Discussions by on:		
The Distribution of Platinum in Sources other than Placers	VIII	211–212
The Geological Survey as an Educational Institution	VII	447
Magnetic Concentration	VII	281

	Vol.	Page
Gibson, Thos. W.—Con.:		
Discussions by on—Con.:		
Suggested Improvements to the Mining Laws in Canada	VII	471, 472
The Undeveloped Mineral Resources of Ontario	VII	392
Reports by:		
Ontario mineral production, 1900	IV	303 et seq.
1903	VII	425–430
industry 1902	VI	463–467
Views on:		
A Canadian Department of Mines	V	596
Computation of mineral statistics	VI	457
Min. refs	VII	269
	VIII	10
Gifford, J. R.:		
Death of	VIII	4
Gilbert River goldfield, QUE.:		
Bed-rock of, paper by Dresser	VIII	259–262
Gilbert River Goldfields Co.	VIII	259
Production, 1899	III	188
Gilchrist iron process:		
Invention of	VI	29
Gillies Bay, TEXADA ISLAND, B.C.:		
Cretaceous rocks at	X	244
Gilman, E. W.:		
Elected councillor (1907)	X	17
Gilpin, Dr. E.:		
On gold mining in Nova Scotia	IV	46, 47
On testing wire rope	IV	43, 44
Gilsonite:		
Utah, U.S.A.	VI	106
Glacial deposition:		
Lake Superior iron region	VI	248
Glacial drift:		
Atlin Dist., B.C.	V	28
Central North America, depth of	III	30
Diamonds in	III	151, 152
transported by	III	158, 159
Glaciation:		
Animikie iron range	VI	248 et seq.
Boisdale Hills, C.B.	VI	418
Boundary Dist., B.C.	V	375
Bridge River Dist., B.C.	III	24
Canada	III	30
notes by BELL	IX	125
MILLS	VII	177, 183
Evidence of in excavation of Chicago Drainage Channel	III	30
North America	III	30
Nova Scotia gold measures	II	120
	IV	46, 47
Ontario, northern	III	158
western	VI	329
Rocky Mts	V	107
Texada Island, B.C.	X	244
West Kootenay, B.C.	III	4
Gladhaugh copper mine, ELLAMAR, ALASKA:		
Ore deposit at	IX	45

	Vol.	Page
Gladstone Tp., ALGOMA, ONT.:		
Rock movements in, notes by MILLS	VII	180
Glass:		
Discovery of manufacture of	III	135
Fuel in making	VIII	299
Ontario, notes by MILLER	VII	388
Globe, ARIZONA, U.S.A.:		
Copper, occurrence	X	255
Globe Refining Company:		
Graphite mill of	X	91, 92
Glommen River, *see under* Norway.		
"Glory Hole":		
Mother Lode mine, Boundary Dist., B.C.	V	215
Gloucester claims, FRANKLIN CAMP, B.C.	X	174
Glover tower:		
Sulphuric acid manufacturing	VI	393, 395, 396
Gneiss:		
Boundary Dist., B.C.	V	514
Eastern Ontario, notes by HILLE	VI	259
Graphite in	VI	76
Hastings Co., Ont.	V	164
Methuen Tp., Ont., notes by Morrison	VII	305, 306
New Caledonia	VI	169
Nipissing Div., Ont.	VI	75
Oaxaca, Mexico	VIII	272
Ottawa Co., Que.	VII	290
Parry Sound, Ont.	VII	121
Purcell Mts., E. Kootenay, B.C.	V	507
Western Ontario, notes by Brent	VI	327
Goat Creek, SKEENA DIV., B.C.:		
Coal analysis	X	224
seams	X	226
Goderich, ONT.:		
Oil well at	II	210
Gogebic Range, LAKE SUPERIOR REGION, U.S.A.:		
Freight rates on iron	IV	283
Going, Charles B.	X	6
Gold and Gold mining:		
Alluvial:		
British Columbia, statistics	X	183, 184
Cariboo District	X	418
Ontario	II	105
Quebec, notes by Dresser on	VIII	259
Coins:		
platinum alloyed with	VIII	193
Chlorination	V	291
paper by FORBES	VII	308–318
Cyaniding	IV	150
	VII	193
Dredges:		
paper by ROBINSON	VI	214–223
types of	V	88 et seq.
Dredging:		
CLARKE, paper by	V	87–103
gravels	V	89 et seq.
machinery, duty free into Canada	III	167

	Vol.	Page
Gold and Gold mining—Con.:		
Melting	IV	89
	V	7
Milling, *see also* Amalgamation, Stamp mills, etc.		
notes by DEKALB	IV	192 et seq.
with Molybdenite	VI	48
Production in Nineteenth Century, paper by MILLER	VI	27
in Saddle reefs	II	125
Values at depth	IV	47
Australia:		
Bendigo	II	121
British Columbia:		
Dredges, types of	V	88 et seq.
Industry, 1900	IV	293 et seq.
dredging	IV	294
Statistics:		
1900–1	V	572
1902	VI	453
1906	X	183, 185
Atlin Dist.:		
GWILLIM, papers by, on	III	97–101,
	V	21–32
in Glacial drift	V	28
Industry, 1899	III	184
Boundary District	V	174, 373, 516
Bridge River Dist.:		
paper by CIRKEL	III	21–29
Cariboo Dist	II	143
	III	184
Fairview Camp:		
paper by HAMILTON	III	142
Fort Steel Dist.:		
Wild Horse creek	III	3
Franklyn Camp	X	174
Lardeau Dist.:		
Fish river	VII	93
Poplar creek	VII	101, 102
Lilloett Dist.:		
notes by CIRKEL	III	21
Nelson Dist.:		
Athabasca mine	IV	83–90
	V	15
notes by CORLESS	V	525
Poorman mine	II	143
Ymir	III	3,
	V	525
Omineca Dist.:		
industry, 1899	III	184
Kilsalas Canon	X	228
Rossland Dist.:	III	163, 164,
	V	451,
	VII	50, 51
notes by CORLESS	V	524 et seq.
HALL	V	403–423
Skeena Dist.	III	92,
	X	227

	Vol.	Page
Gold and Gold mining—Con.:		
British Columbia—Con.:		
Slocan Dist.	VII	200
Texada Island	VIII	180,
	IX	41,
	X	245
Marble Bay mine	X	249
Vancouver Island:		
notes by BREWER	VI	189, 197
BEST	V	230
West Kootenay	II	75
Canada:		
Statistics:		
1892–1901	VI	69, 72
1901	V	568
1902	VI	454
1906	X	12
notes by JOHNSON	VI	68
Manitoba:		
Occurrences	IV	299
Mexico:		
Los Reyes, paper by SMITH	VIII	272–284
New Brunswick:		
Laws respecting	VII	455
New Zealand:		
Dredging	V	96
1900	IV	298
Nova Scotia:		
Compared with Bendigo	II	121
FARIBAULT, paper by, on occurrence & deep mining	II	119, 244
Industry, 1900	IV	311
1902	VI	449
reasons for inactivity	II	164
SELWYN, paper by	II	162
Laws respecting	VII	457
Origin	II	248
Statistics:		
1898	II	249
1899	III	188, 189
1900	IV	311
1901	V	583
1902	VI	649
STUART, notes by	VI	44–48
Value:		
per ounce	II	251
per ton of ore	IV	45
Veins:		
deposition	II	119
extent	II	125
structure	II	128

Bismark	II	126
Copper Lake	II	165
Montague	II	163
Oldham	X	426
Richardson mine	II	126, 246
Waverley	IV	45, 53

	Vol.	Page
Gold and Gold mining—Con.:		
Ontario:		
Alluvial	II	105
Carter, notes by on	VII	117–139
in Eastern, paper by Knight	VII	210–244
Miller	V	238
Indian reserves	II	242
Industry, 1898	II	243
1900	IV	302 et seq.
1901	V	580
Mining divisions established	III	100
Royalties	III	113
Occurrences, notes by Miller	VII	380
Statistics:		
1901	V	581
1902	VI	454, 464
1903	VII	425, 429
in Western, paper by Brent	VI	326–335
Algoma Dist.	VIII	183
milling	IV	176
Belmont, Peterborough Co., mines in	IV	303
Bruce mines	X	169
Deloro:		
treatment, paper by Kirkegaard	IV	113–122
Lake of the Woods:	II	239, 240
Sultana mine	II	237–243
Marden Island	II	239
Nipissing Dist.	IV	277
Sudbury Dist.	V	534
discovery in	VII	499
Vermilion river	II	105 et seq.
Quebec:		
Alluvial	VIII	259
Mining in 1900	IV	308
Statistics:		
1898	II	65
1899	III	188
Beauce Dist.:		
Mining in	II	63
Chaudiere	II	212
Chibougamau region	VIII	363
	IX	219, 222
Eastern Townships	VIII	262 et seq.
South Africa:		
Transvaal, mining in	IV	40–41
United States:		
California, mining in	IV	46, 47
Comstock lode, Nevada	VI	26
Goldfield, Nev., paper by Jennings	VIII	39–45
Republic, Wash. notes by Cirkel	V	274 et seq.
Yukon:		
Bank charges on	III	214
Bullion, shipments to U.S.	II	257
1900	III	214

	Vol.	Page
Gold and Gold mining—Con.:		
Yukon—Con.:		
Discovery	v	598
Dredging, 1900	iv	297
Production:		
Notes by BELL	v	574
COSTE	iii	222
TYRRELL	ix	15
1898-1901	v	599
1899	iii	183
1900	iv	295
1905	ix	15
Quartz, veins	iii	212
Royalties on	ii	251
	iii	210, 213, 214, 215
WADE, address by, on	v	597
Conrad mining division	x	211
Klondike, gravels, classes of	iii	124, 213, 214
McCONNELL, paper by on	iii	124–127
nuggets	iii	125
occurrences	iii	216
***THE GOLD BEARING SANDS OF THE VERMILION RIVER.** EVANS	ii	105-107
Gold & Silver Extraction Co. of America:		
Republic, Wash., mill	v	276
"Gold and Silver Mining Act", *see under* Mining Law and Ontario.:		
"Gold Belt":		
Eastern Ontario:		
map	v	239
paper by KNIGHT	vii	210–244
Nova Scotia, extension	ii	119
Gold Bottom Creek, KLONDIKE	iii	124
Gold Brook, MATTAWAN RIVER, ONT.	vi	331
Gold Commissioner:		
Yukon, fees 1900	iii	215
Gold Creek colliery, BLAIRMORE, ALTA.:	vi	375
Gold Drop mineral claim, BOUNDARY DIST., B.C.:		
Mineralization	v	173
Gold Hill, CONRAD DIV., Y.T.:		
Gold and tellurides found on	x	213
Gold Hill, RAINY RIVER DIST., ONT.	vi	332
Gold Hill mine, MANITOU, ONT.	vi	332
†***GOLD MEASURES OF NOVA SCOTIA AND DEEP MINING, THE.** FARIBAULT	ii	119–129
Discussion on by:		
ADAMS, ANDREWS, BELL, COSTE, DAWSON, DOUGLAS, FARIBAULT, HARDMAN, INGALL, LEDOUX, MACDONALD, STUART	ii	244–250
Gold Mile mineral claim, POPLAR CREEK DIST., B.C.	vii	106
‡***GOLD MINING IN NOVA SCOTIA FROM 1860 TO 1899.** SELWYN	ii	162-165
Gold Panner mineral claim, RAINY RIVER DIST., ONT.	vi	332
Gold Park mineral claim, POPLAR CREEK DIST., B.C.	vii	103, 104

* See Summaries, page 9
† " " 10
‡ See Summary, page 13

	Vol.	Page
Gold Reef claim, CONRAD, Y.T.:		
Notes by CAIRNES	X	213
Tellurides discovered on	X	214
Gold Run, ATLIN DIST., B.C.:		
Gold production, 1900-1901	V	32
Notes on by GWILLIM	V	26 et seq.
Gold Run, Y.T.		
Gold royalties 1900	IV	296
Golden, B.C.:		
Copper	III	185
Golden Cache mine, LILLOETT, B.C.	III	21
Golden Gate gold mine, RAINY RIVER DIST., ONT.	VI	332
Golden Horn gold mine, LAKE OF THE WOODS DIST., ONT.	VI	332
Golden Lake mineral claim, EAGLE LAKE, RAINY RIVER DIST., ONT.	VI	332
Golden Star gold mine, LAKE OF THE WOODS, ONT.:		
Notes by Carter	VII	132, 136
Goldenville Dist., N.S.:		
Gold mining in	II	247
veins	II	127
***GOLDFIELD DISTRICT, NEVADA, THE.** JENNINGS	VIII	39–45
Goldolinite:		
Tache, Tp. Que.	IX	73
Goldsmith mineral claims, POPLAR CREEK DIST., B.C.: *see also* Swede group.		
Mineralization at	VII	106
GOODWIN, Dr. W. L.:		
Chairman, Eastern Ontario Branch	V	606
Discussions by on:		
Are there Diamonds in Ontario ?	III	196
The Bornite Ores of B.C. and Yukon	VIII	181
The Distribution of the Platinum Metals in other Sources than Placers	VIII	210
Electric Smelting	VIII	155
The Modern Blast Furnace Laboratory	VI	472
The National Importance of Mining	V	144–148
Natural Gas in Ontario	III	207
The Need of a Provincial Museum in Ontario	VIII	73
The Old Valley Gravels of the Klondike	III	212, 214
The Status of the Mining Profession	X	337–339
The Value of an Undeveloped Mining Claim	VIII	118
The Volcanic Origin of Natural Gas and Petroleum	VI	476
Elected Vice-President of Institute, 1905	VIII	34
Papers by:		
†***Analysis of Corundum and Corundum Rock, The***	IV	180–183
‡***Recent Advances in Electro-Chemistry and Electro-Metallurgy***	III	133–140
Resolution by, respecting branches	V	605
Views on:		
A Canadian Department of Mines	V	595
Civil Engineers' Bill	V	561
Magnetic Surveying	VI	478

* See Summaries, page 92
† " " 31
‡ See Summaries, page 22

	Vol.	Page
GOODWIN, W. S.—Con.:		
Water power, notes by, on	VI	468
Min. Ref.	I	17
	VIII	9, 20, 37, 265
Gordon River, SAN JUAN DIST., V. I., B.C.	VI	189, 199
Goroblagodat District, *see under* Russia.		
Gosfield Tp., Ont.:		
Natural gas in	III	208
Gossan:		
Douglas Co., Oregon, U.S.A.	IV	186 et seq.
Mother Lode mine, Boundary Dist., B.C.	V	517
St. Stephen, N.B.	IX	238
Sudbury Dist., Ont.	V	528
Gottingen, *see under* Universities, *under* Germany.		
Goudreau Lake, MICHIPICOTEN, ONT.:		
Pyrite at	X	122
analysis	X	123
Government, *see* Legislation, Mining Legislation, Canadian Government, *also* names of Provinces.		
Assay Office:—		
Belleville, Ont.	V	138
DONALD'S views	V	150
Montreal, Que.	V	154
Need for	V	132, 136, 138
Vancouver, B.C.	V	577
WELLS' views	V	151
Gowrie and Block House Collieries, Ltd., PORT MORIEN, N.S.	IV	310
Production, 1901	V	583
Grace Gold mine, MICHIPICOTEN, ONT.	VII	122
Gracey, A. H.:		
Mgr. Imperial Development Syndicate	VII	95
Grade:		
Irrigation ditches, Hawaiian Islands	VII	74
Grafter copper claim, WHITEHORSE, Y.T.	X	198
Graham Creek, ATLIN DIST., B.C.:		
Gold production, 1900-1901	V	32
Graham's Law of the Diffusion of Gases	IV	142
Grahamite:		
Notes by COSTE	VI	104
Granby Con. M. S. & P. Co., BOUNDARY DIST., B.C.:		
Notes by LEDOUX	V	175
Granby smelter, GRAND FORKS, B.C.	VII	46
Grand Forks, KETTLE RIVER MINING DIV., B.C.:		
Crystalline rocks near	V	365
Ore deposits, notes by CORLESS	V	508
Smelter at	VII	46
operations	X	170
Grand Forks, Y.T.:		
Gold royalties, 1900	IV	296
Grand River, LAKE ERIE, ONT.:		
Gypsum on	VII	166, 387
Grand Trunk Pacific Railway, *see also* Railways.		
Quebec, copper-bearing rocks on route of	VII	399
Grangesberg, *see under* Sweden.		

	Vol.	Page
Graniodiorite:		
Franklin camp, B.C.	X	176
Granite:		
"Canadian"	III	159
Crystals, composition of	VI	77
Platinum in	VIII	200
Quartz veins in	V	18
	V	509
British Columbia:		
Atlin Dist.	V	26
Boundary Dist.	V	172, 365
Fairview Camp	II	143, 146, 147
Franklin Camp	X	173
Lardeau Dist.	VII	90
Nelson Dist., Athabasca mine	V	15
Rossland Dist., B.C.	V	519
Slocan Dist.,	V	10
	VI	148
(southern) analyses	II	78
South Eastern	V	508
Germany:		
Sohland	IX	253
Nova Scotia:		
Boisdale Hills, C.B.	VI	421, 429
Gold measures, notes by FARIBAULT	II	119
later origin than gold formation	II	248
ultimate source of gold	II	249
Ontario:		
Atikokan Dist.	IX	289, 292
Copper Cliff,	V	532
Frontenac Co.	VII	211
Hastings Dist.	V	240
Rainy River	VII	125
Resources, notes by MILLER	VII	389
Sudbury Dist.	V	235
Western, notes by BRENT	VI	328
Quebec:		
Chibougamau Dist.	IX	20
Production, 1900	V	350
United States:		
Butte, Mont.	V	297
Mason Valley Mts., Nev.	X	257
Mesaba iron range	VI	251
Granite Creek, ALBERNI DIST., V.I., B.C.	VI	189, 197
Granite Crossing, KOOTENAY RIVER, B.C.:		
Molybdenite	VI	51
Granite Mt., ROSSLAND DIST., B.C.:		
Formation	V	520
Granite-porphyry:		
Ascot Belt, Eastern Tps., Que.	V	83
Yerington, Nev.	X	259
Grantham Iron Works, DRUMMONDVILLE, QUE.	IV	305
Pig iron production, bounty paid on ,1900	IV	313
Granza furnace	II	14
Graphite:		
Alteration product of bituminous coal	VIII	240

	Vol.	Page
Graphite—Con.:		
Artificial:		
method of manufacture	X	103
statistics	X	104
Concentration of	X	92
Consumption of, in the arts	VIII	345
Crushing	IV	210, 223
and sizing	IV	212
Market	X	93
Occurrence:		
BATEMAN, notes by	VIII	343–347
Canada, paper by BRUMELL	X	84–104
in Pegmatic dykes	VII	255
Prices	X	96
Statistics	X	99–101
Canada, 1901	V	571
1902	VI	455
Tests for	VI	293
Uses	V	251,
	X	96
Ontario:		
Cobalt Dist	X	58
Industry	IV	303
Mines of, notes by CARTER	VII	160
Occurrences, notes by MILLER	VII	385
Production, 1902	VI	464
1903	VII	392, 426, 430
Renfrew Co	V	246
Silver Islet, in vein of	III	160
Sudbury Dist	X	55
Quebec:		
Buckingham Tps., Que	II	64,
	VI	76
Industry, 1899	III	188
Production, 1898	II	65
1900	V	350
Graphitic-diabase:		
Mesaba iron range	VI	251
Graphitic slates:		
Occurrence in Keewatin formation	III	159
Grassy Island, BOW RIVER, ALTA.:		
Coal on	X	234
Gravel:		
Concrete, making with	VIII	108
Diamond-bearing	V	62
Gray-Hepplewhite safety lamp:		
Blakemore, views on	VI	200
Invention of	V	390
Great Britain:		
Board of Trade, report by, on joint stock companies	IV	245
Coal industry, notes by MILLER	VI	30
production, 1850-1900	VI	31
1868-1898	VI	70
mining accidents, 1902	VI	448
percentage of, caused by machine mining	VI	449

	Vol.	Page
Great Britain—Con.:		
Company Law	IV	245
Iron:		
imports of Spanish	IV	197
industry:		
1898	II	58
notes by MILLER	VI	28
production, 1898	II	58
1901	V	132
reserves	X	141, 146
trade, 1899	III	118, 119
and steel production, 1807-1900	VI	29
Joint stock companies in	IV	245
Safety lamps, regulations respecting in coal mines	V	379
Technical education	V	146
Great Natashquan River, QUE.:		
Iron sands	IV	96
Water power	IV	97
Great Northern Railway, *see under* Railways.		
Great St. James St., Montreal.:		
Survey first established at	X	345
Great Slave Lake:		
Molybdenite	VI	49
Great Western mine, ROSSLAND, B.C.:		
Vein	V	522
"Greenalite"	VI	278, 283
Greenhills River, EAST KOOTENAY, B.C.	IV	229
Greenockite:		
West Kootenay, B.C.	II	76
Greenstone:		
Bitumen in	VI	77
Boundary Dist., B.C.	V	365, 366
ores in	V	369 et seq.
Copper Cliff, Ont., analyses	V	530
Franklin Camp, B.C.	X	171
Lake of the Woods, Ont.	X	67
Sudbury Dist., Ont.	V	528
	IX	224
	X	313
Tar Point, Gaspé, Que.	VI	127
Greenwater Lake, SHEBANDOWAN LAKE DIST., ONT.:		
Iron ore on	IV	281,
	V	51
notes by HILLE	V	58 et seq.
Greenwood Camp, BOUNDARY DIST., B.C.:		
Ores, grade	V	175
values in	V	374
Grenville series:		
Frontenac Co., Ont.	VII	215
Gneisses of	IX	311
Graphite in	X	87
Limestones of	VII	384
Ontario, iron ores in	IV	267
Grenville Tp., ARGENTEUIL CO., QUE.:		
Graphite, analysis	X	95
occurrence	X	89, 90
LOGAN, work in	X	358

	Vol.	Page
Greywacke:		
Nipissing District, Ont.	IV	276
Gribbel Island, B.C.:		
Copper on	VIII	172, 174, 178
	IX	40
	X	196
Gribble's shaft, BRUCE MINES, ONT.	X	159
Griffiths, A. P.	VII	206
Grindstones:		
Canadian production ,1901	V	572
Nova Scotia production, 1889	III	189
Grizzlies:		
Knob Hill-Ironsides mine, Phoenix, B.C.	V	430
Grondal, Gustaf.	X	263
Grondal ball mill:		
Description of	X	264
Grondal briquetting process:		
BENNIE, paper by, on.	X	261, 273
Description of.	X	267
HAANEL, notes by, on.	VIII	156
Grondal-Delwik separator	VI	11
Notes on by WELLS.	VI	19
Gros Cap, MICHIPICOTEN HARBOUR, ONT.:		
Hematite	IV	280
Grossularite, *see also* Garnet:		
Boundary Dist., B.C.	V	369
Platinum associated with	VIII	202
"Groundwater":		
Definition by HILLE	V	53 et seq.
Grouse Mt., ROSSLAND DIST., B.C.:		
Formation.	V	520
Groves, J.:		
Discussion by, on:		
Some Laboratory Experiments in Making Steel from Iron in the Electric Furnace.	IX	135
Guadalcanal, *see under* Spain.		
Guano:		
Notes by MILLER.	VI	42
Guelph formation (Silurian):		
Essex County, Ont.	III	82
salt water invariably found in.	III	75
Natural gas in	III	68, 69, 80
Petroleum discovered in.	VII	175,
	X	84
Tilbury oilfields, Ont.	X	82
Western.	II	208, 209
GUESS, H. A.:		
****A Laboratory Amalgamating Device, and Comparisons with Actual Mill Results***	I	10–14
Guiana, S. AMERICA:		
Gold production, 1890-1900.	VI	25
Gunflint Lake, THUNDER BAY DIST., ONT.:		
Animikie formation on.	VI	247, 249, 253
Gunthorpe Lake, MESABI DIST., MINN.	VI	462

* See Summaries, page 1

	Vol.	Page
GWILLIM, J. C.:		
Discussions by, on:		
The Bornite Occurrences of B.C. and Yukon	VIII	182
The British Columbia Zinc Problem	VII	374, 375, 376
The Dry Ores of the Slocan	VII	208
The Life History of Coal Seams	VIII	241
The National Importance of Mining	V	139
Uniform Mining Statistics in Canada	VIII	171
Elected Councillor of Institute, 1906	IX	27
1907	X	17
Notes by, on Slocan Dist., B.C.	II	78
Papers by:		
**Characteristics of the Atlin Gold Field*	V	21–32
†Notes on the Atlin Gold Fields	III	97–101
‡Notes on the Life History of Coal Seams	VIII	235–240
¶Notes on Some Western Coals	VII	422–424
‖The Status of the Mining Profession	X	321–327
Minor refs.	X	5, 15, 330
Gypsum:		
Canadian statistics, 1901	V	572
1902	VI	454
1906	X	12
Manitoba:		
Lake Manitoba	V	578
Lake St. Martin	IV	299
New Brunswick:		
Occurrence	IV	309
Nova Scotia:		
Baddeck District	IV	312
Production, 1899	III	189
1901	V	584
Ontario:		
Essex County	III	74
Mining of	VII	166
Occurrences	VII	387
Production, 1893-1903	VII	392
1902	VI	464
1903	VII	430
Tilbury	X	82
Western	II	189, 208
Gysinge, *see under* Sweden.		

H

HAANEL, DR. EUGENE:		
Address by on magnometric surveying	VI	477
Appointed Superintendent of Mines	IX	101
Discussion by, on:		
The National Importance of Mining	V	592
Paper by, on:		
°*Electric Smelting*	VIII	132–154

* See Summaries, page 38
† " " 19
‡ " " 103
¶ See Summaries, page 88
‖ " " 146
° " " 97

	Vol.	Page
HAANEL, DR, EUGENE—Con.:		
Views on the Grondal Process	VIII	156
Min. refs	VII	267
	X	111
Hackney, W.:		
On coking anthracite dust	IX	327
Hagarty Tp., RENFREW CO., ONT.:		
Allanite	VII	254
Hague, Dr. Arnold:		
On the relation of dykes to ore bodies	II	85
Haileybury, ONT.:		
Cobalt ores at	VII	385
Silver discovered near	VII	142
Haines' Mission, LYNN CANAL:		
Copper near	X	196
Haliburton, DYSART TP., HALIBURTON CO., ONT.:		
Corundum	III	200
Galena	VII	157
Picturesque scenery in	VII	178
Haliburton Land & Immigration Co., TORONTO, ONT.	VI	50
Halifax copper mine, HALIFAX TP., QUE.	V	81
Halifax County, N.S.		
Excursion of Institute in	IV	39
Gold mining in	X	426
quartz	IV	210, 212 214
Hall, Prof. James	IX	91
Hall Mines, NELSON, B.C.:		
Labour	III	173
Smelter returns, 1899	III	186
Hall Mining & Smelting Co., NELSON, B.C.:		
Lead bounty to	IV	313
smelting practice	IX	58
HALL, OLIVER:		
**The LeRoi Mine, Rossland, B.C.*	V	403–423
Halliday, David	X	78
Hallidie ropeway:		
Ymir mine, B.C.	III	8
Hall's Brook, DUDSWELL TP., QUE.	VIII	260
Ham Tp., QUE.	VIII	267
Copper in	VIII	268
Serpentine in	VIII	268
HAMILTON, A. McL.:		
†*Notes on Reverberatory Furnace Smelting at Anaconda*	VIII	349–357
Prize awarded to	IX	8
HAMILTON, J. F.:		
‡*The Relative Attraction of some Common Minerals for Residuum Oil*	VII	185–191
Hamilton, ONT.:		
Blast furnace at	IV VII	267, 302, 155
records, 1898	II	60
Nickel refining	V	205
Hamilton Blast Co., Ltd.:		
Pig iron production, bounty paid on, 1900	IV	312
Hamilton Cataract Power, Light & Traction Co., (near) ST. CATHARINES, ONT.:		
Hydraulic works of	VIII	109

* See Summaries, page 55 † See Summaries, page 108 ‡ See Summaries, page 79

	Vol.	Page
Hamilton formation (DEVONIAN):		
Petrolea, Ont., natural gas and petroleum	III	82
Tilbury, Ont.	X	81
Western Ontario	II	190
Hamilton Mfg. Co., gold dredge:		
Description by CLARKE	V	91 et seq.
Hamilton Steel & Iron Co., Ltd.:		
Exhibit at Buffalo	V	254
Iron-bar production, bounty paid on, 1900	IV	313
ore imports, 1900	V	566
Hammond Gold Reef mine, RAINY RIVER, ONT.:		
Fault at, notes by HILLE	VIII	188, 189
Vein	VIII	190
Hammond, John Hays	X	18
Report by on shaft sinking in South Africa	II	245
Hammond Reef, SAWBILL LAKE, R. R. DIST., ONT.	VI	331
Hamner Tp., NIP., ONT.	II	105
Handy mineral claim, POPLAR CREEK DIST., B.C.	VII	104
HANES, GEORGE S.:		
**Solubility of Cobalt-Nickel Ores in Ammonia*	VIII	358–362
Hanlan mica mine, N. BURGESS TP., ONT.	VII	427
HANSEN, C. C.:		
Discussion on:		
Mining Pumps	III	197, 198
Paper by:		
†*Power Drills*	V	484–492
Hanyang, *see under* China.		
Harbord	VIII	143
Views on electric production of steel	VIII	153, 154
Harcourt Tp., HALIBURTON CO., ONT.:		
Molybdenite	VI	50
concentration tests at	VI	59
Hardie Mt., COPPER CREEK, B.C.:	II	13, 14
HARDIE, WM. D. L.:		
Discussion on:		
Safety Lamps and Colliery Explosions	VI	202–206
Papers by:		
‡*Colliery Manager, The*	IX	200–209
¶*Exhaust Steam Boiler Feed Water Heaters*	VII	505–530
‖ *Indicator Cards*	VIII	285–289
° *Wire Ropes*	V	33–41
Hardman, John. E.:		
Discussion by, on:		
Acetylene Gas as a Mine Illuminant	II	229–232
Adjustment and Control of the Stamp Mill	II	205–206
The Bed-Rock of the Gilbert River Goldfields	VIII	264–265
A Canadian Department of Mines or Geological Survey	IX	111
A Description of the Sultana Quartz Lode	II	243
The Gold Measures of Nova Scotia and Deep Mining	II	244, 245, 250
An Improved Method of Feeding Water to the Stamp Mill Mortar	II	232, 236
Nickeliferous Pyrrhotite at Malachite Point	IX	222
Notes on the Ymir mine and its mill practice	III	169

* See Summaries, page 108
† " " 56
‡ " " 118
¶ See Summaries, page 92
‖ " " 105
° " " 38

	Vol.	Page
Hardman, John E.—Con.:		
Discussion—Con.:		
The Old Valley Gravels of the Klondike	III	210–216
The Sampling of Argentiferous and Auriferous copper	II	226
The Small Economies of Mining	III	170
The Stewart River Gold Dredge	VI	469
Suggested Improvements to the Mining Laws in Canada	VII	470
Elected First President of C.M.I.	I	17
President, C.M.I., 1899	II	252
Lecture by, on Chibougamau Dist.	IX	16
Papers by:		
**Method of Cost Accounting, with special Reference to Mines*	III	37–67
†*National Importance of Mining, The*	V	113, 125
		585
Resolution on Ontario Mining Taxation, 1907	X	14
Views of, on:		
Chibougamau Dist., Que.	IX	218
Civil Engineers' Bill	V	561
Vote of thanks to	III	220
Min Refs.	VI	480, 481,
	VII	11,
	VIII	10
	IX	24, 221,
	X	106
Hardware:		
Canadian exports 1903-04	VIII	132
Hare:		
Oxy-hydrogen blast introduced by	VIII	193
Harewood coal mines, NANAIMO, V.I., B.C.:		
Notes by BREWER	VI	188, 195
		196
Harman, Dana:		
On stamp milling of free gold ores	IV	192
Harold Lake, SEINE RIVER, ONT.:		
Granite at	VIII	184
Harricanaw River, JAMES BAY:		
Huronian rocks on	X	105
Harrigan Cove, N.S.:		
Gold mining at	IV	311
Harris, (?):		
Bruce mines, examined by	X	149
Harris air-lift:		
Description and plan by KIRKEGAARD	V	266 et seq.
Harris distributor:		
Description of	IX	59
Harris, Henry:		
Matte separator invented by	IX	58
Harris, Lloyd	VII	414
‡***HARRIS SYSTEM OF PUMPING BY COMPRESSED AIR, AS APPLIED AT THE DELORO MINE, THE.*** KIRKEGAARD	V	265–273
Harrison punching machine for coal cutting	V	110
Hart Corundum Co., HAMILTON, ONT.	VII	160
Hart River, *see under* Africa, S.		

* See Summaries, page 17
† " " 43
‡ See Summaries, page 49

	Vol.	Page
Harvey Hill copper mine, LEEDS, QUE.	II	62,
	III	138,
	V	81,
Harz Mountains:		
Platinum in	VIII	198
Haskin's Creek, LARDEAU DIST., B.C.	VII	101
Hastings Co., ONT.:		
Actinolite	VII	167
Alluvial gold in	VII	118
Asbestos mining	VII	167
Corundum occurrences	III	200,
	VII	159, 418, 419
Formation	IV	220
Galena ores	VII	143
Gold mining	V	238
Iron:		
Industry	IV	266
Mining in	VII	152
Lead mining in	VII	384
Pyrite:		
Deposits	VII	157,
	X	124, 128
Production, 1903	VII	426
Talc mining in	VII	167
Hatch, Dr.:		
Examination of Bruce mines by	X	156
Haulage:		
Alberta Ry. & Coal Co., endless rope system	V	109
Brayton Domain colliery, England	IX	403
Choice of system in coal mines	IX	206
Compressed air	IV	42
Coal Creek colliery, B.C.	IV	160 et seq., 238
Electrically driven	II	185
Knob Hill-Ironsides mines, Phoenix, B.C.	V	432
LeRoi mine, Rossland, B.C.	V	420
haulage plant, paper by MACDONALD	V	309–342
Lethbridge coal mine, Alta.	VI	373
Methods and costs, notes on by FORREST	VI	4
Oil-burning engines for	VIII	63
Pioneer iron mine, Minn.	VII	349
Pulleys	V	39
Susquehanna Coal Co., Pa.	IX	380, 384
Wabana iron mines, Nfld.	IV	65
description and diagram	III	132
Wire rope, paper by HARDIE	V	33–41
Haultain, H. E. T.:		
Discussion by on magmatic waters	X	315, 316
Elected Councillor, 1907	X	17
Haultain-Stovel oil process:		
Molybdenite concentration by	VII	164
Hawaiian Commercial & Sugar Co., MAUI	VII	74
Hawaiian Islands:		
Geology of	VII	70
Petroleum for fuel in	VIII	59–67
Water supply for sugar plantations	VII	70–81

	Vol.	Page
Hawaiian Sugar Co.:		
Irrigation ditch of	VII	74
Hay, A. Marshall:		
Discussion by on :		
The Small Economies of Mining	III	171
Elected Councillor, 1906	IX	27
Resolution by on pig iron bounties	IX	25
Min. Ref.	X	14
Hazaribagh District, *see under* Bengal *under* India.		
Hazelton, B.C.:		
Description	III	93
Distributing point for Omineca District	X	228
Head-frame:		
LeRoi mine, Rossland	V	330
Rossland mines, B.C.	V	467
Susquehanna Coal Co., Pa.	IX	378
Head Lake, ONT.:		
Iron ore	V	51
Head sheaves:		
Notes by GARDE	VI	305
Head works:		
Ironsides mine, Phoenix, B.C., plan	V	425
LeRoi mine, Rossland, B.C.	V	328
Heat, *see also* Calorific Power.		
Carried out of furnace by blast	VIII	123
Furnace gases	VIII	125
Heating:		
Plant, LeRoi mine, Rossland	V	328
Water gas for	VIII	300
Heberli separator	VI	11
Notes on by WELLS	VI	17
Hecla mine, COEUR D'ALENE DIST., IDAHO	IV	255
HEDLEY, ROBERT R.:		
Elected Councillor of Institute	VIII	34
Vice-President of Institute, 1902	V	603
Paper by:		
***New Matte Separator, A**	IX	58–63
Min. Ref.	VI	440
Heine water tube boilers	VI	182
Helen H. Gardner mine, COPPER MT., SIMILKAMEEN DIST., B.C.:		
Map	V	495
Notes by Scott	V	493
Helen iron mine, MICHIPICOTEN HARBOUR, ONT.	IV	280
Available ore	III	121
CARTER, notes by, on	VII	154
Discovery and development of	III	121
	IV	302
Hematite	IV	220
Operations, 1900	IV	301, 302
Production, 1902	VI	465
1903	VII	425
Pyrite at	VII	157, 386,
	X	121
WILLMOTT, notes by, on	VII	260–262
Helena Frisco Consolidated Company, GEM, IDAHO	IV	254–264
Helm, Dr.:		
Quoted on use of zinc in prehistoric times	VI	36
Helme, Wm.	IX	394

* See Summaries, page 111

	Vol.	Page
Hematite, *see also* iron.		
Attraction of, for oil	VII	187
Concentration	VI	6
Containing cinnabar	III	144
Crushing	IV	208, 210, 220
Electric smelting of	VIII	143,
	X	131
Magnetic concentration of	VII	273
permeability of	VI	11
separation	VII	282
British Columbia:		
Boundary Dist., King Solomon claim	V	375
Kitchener	V	76
Newfoundland:		
Bell Island	IV	35
Wabana	III	193
	IV	63
Nova Scotia:		
Ferrona	IV	35
Long Island, Boisdale Hills, C.B.	VI	432
Ontario:		
Michipicoten	III	192
Harbour	VI	280
Occurrences	IV	265, 268
Parks Lake, Algoma Dist.	IV	281
Spain:		
Bilbao Dist.	IV	199, 203
United States:		
Ely, Minn.	VII	338
Negaunee, Mich.	VII	332
Hemlock:		
For charcoal	II	46
Sudbury Dist., Ont.	VII	495
Hemple (?)	X	200
Henderson chlorization process	VIII	337
Bruce mines, Ont., trial of	X	153
Henderson talc mine, NEAR MADOC, ONT.	VII	167
Hendryx process:		
Extraction by	VII	207
Notes by THOMPSON	VII	194
HENRETTA, C. M.:		
***Bankhead Coal Mines**	VIII	215–220
Henriksen, F.	VIII	208
Hepplewhite-Gray safety lamp:		
For testing fire-damp	VI	200
Herbertson, Dr. A. J.:		
Views on functions of a geographer	VI	325
Heroult, P.:		
Electric smelting experiments	VIII	133
Heroult electric furnace	III	137
Description of	VIII	148
Herrang, *see under* Sweden.		

* See Summaries, page 101

	Vol.	Page
Herreschoff furnace	VI	306,
	IX	59
Canadian Copper Co.	VII	498
Roaster, notes by SJOSTEDT	VII	482
Hersey, Dr. Milton L.:		
Cleveite analyzed by	VII	247
Min. refs.	IX	221
	X	94
Hessite, *see also* Tellurides.		
Lake of the Woods, Ont.	VI	334
West Kootenay, B.C.	II	76
Wheaton River, Y.T.	X	214
Hetta Inlet, PRINCE OF WALES ISLAND:		
Copper mining at	X	196
Hewett mine, SLOCAN DIST., B.C.	V	11
Hibernia iron mines, NEW JERSEY, U.S.A.:		
Concentration at	VI	15
Highland Boy smelter, UTAH, U.S.A.:		
Calcining furnaces	VI	306
Highland concentrator, SLOCAN DIST., B.C.	VI	152
Highwood River, BOW RIVER, ALTA.:		
Coal at	X	236
Hill, Jas. J.:		
Acquisition of coal lands in Kootenay Pass, B.C.	VI	232
Min. ref.	VII	434
Hill, Leslie:		
Discussion on:		
The Small Economies of Mining	III	171
On eight-hour law in British Columbia mines	III	168
Hill, Robt. T.:		
Report by on Beaumont oilfields	VI	103, 112
Mt. Peleé eruption	VI	81
Views on asphalts	VI	89
Origin of petroleum	VI	73, 90, 93
HILLE, F.:		
**Atikokan Nickeliferous Pyrrhotite Deposits and their Origin, The*	IX	285–301
†*Correction in the Classification of our Gold Formation, A*	VIII	183–191
‡*Electric Transmission and Electric Drills for Mines*	II	166–185
¶*Genesis of the Animikie Iron Range*	VI	245–287
‖*Iron Ore Deposits of Western Ontario and their Genesis*	V	49–61
Himalayan Mts., *see under* India.		
Hinchman, C.:		
On the steel industry of the United States	IV	24–26
Hind, H. Youle:		
On gold mining in Nova Scotia	II	162
Hinkle furnace:		
Charcoal consumption	II	46

* See Summaries, page 123
† " " 100
‡ " " 13
¶ See Summaries, page 66
‖ " " 39

	Vol.	Page
HIXON, HIRAM W.:		
Discussions by, on:		
The Education of Mining and Metallurgical Engineers	IX	163
The Origin of Sudbury Ore-deposits	IX	227, 230, 234
The Ore Deposits of the Cobalt District, Ont	X	54–57
Some Laboratory Experiments in Making Steel from Iron Ores in the Electric Furnace	IX	135
Papers by:		
**Magmatic Waters*	X	301–308, 312–4
†*The Ore Deposits and Geology of the Sudbury District, Ont.*	IX	223–227
‡*Smelting of Cobalt Ores*	X	74–76
Minor refs.	IX	24, 316, 318
Hjuljerm, *see under* Sweden.		
HOBART, FREDERICK:		
Discussion by, on:		
Uniform Mining Statistics in Canada	VIII	171
Papers by:		
¶*Canadian Metallurgical Products for the Far East*	VIII	158–160
‖*Mining Statistics*	VIII	162–167
°*Some Possibilities of Mining in Canada*	VI	313–316
Views on:		
Compiling mineral statistics	VI	457
Shaft-lining with cement	VII	433
Minor refs.	VI	473
	VII	10
	VIII	9, 168
	IX	13, 24
	X	5, 12
Hobbs, Prof. Wm. H.:		
On diamonds in America	III	150
glacial drift	III	152, 153
Menominee region	IX	127
Min. ref.	IX	124
Hobman, A. C.	IX	350
Hobson, John B.:		
Address by, at Provincial Mining Ass. of B.C.	VI	324
Elected Councillor, C.M.I., 1898	I	18
Min. ref.	X	420
Hochelaga, QUE.		
Artesian water at	VIII	90
capacity of	VIII	98
Hochsetter, Von:		
Dunite described by	IX	312
Hodges, A. B. W.:		
Elected councillor 1904	VII	22
Hodgson, Thomas	VII	414
Hoepfner, Carl:		
Death of	IV	288

* See Summaries, page 145
† " " 120
‡ " " 129
¶ See Summaries, page 98
‖ " " 98
° " " 68

	Vol.	Page
Hoepfner nickel refining process	III	245
Canadian Copper Co.	V	206
Copper-nickel	V	203
Description	V	199 et seq.
Ulke, views of on	V	393 et seq.
Hoffman, A. W.:	VI	33
Hoffman, G. C.:		
Report by on Canadian graphite, ref. to	X	94
Hoffman shaft, TORBROOK, N.S.:		
Iron analysis	IX	34
Sinking of	IX	31
Hoists and Hoisting:		
Centre Star mine, Rossland, B.C.	V	456, 461, 462
Coal Creek colliery, B.C.	IV	238
Electric:		
Josie mine, Rossland, B.C.	V	464
Engines:		
Ironsides mine, Phoenix, B.C.	V	437
LeRoi mine, Rossland, B.C.	V	406
description	V	333
Fuel costs	V	336
GARDE, notes by, on	VI	301, 302
Knob Hill mine, Phoenix, B.C.	V	444
Labour costs	V	336
LeRoi mine, Rossland, B.C., paper by MACDONALD	V	309–342
Minnesota iron mines, costs	VII	366
Mother Lode mine, Boundary Dist., B.C.	IX	345
Pioneer iron mine, Minn.	VII	350
Quebec, asbestos mines	V	354
Rope:		
Elongation	V	39
Notes on, by HARDIE	V	33 et seq.
HOISTING AND HAULAGE IN MINING OPERATIONS. A DESCRIPTION OF THE PLANT ON THE LE ROI MINE, ROSSLAND, B.C. MACDONALD	V	309–342
Holden, E, C.:		
Min. ref.	VII	206
HOLDICH, A. H.:		
†***On the Establishment of Science Classes, &c.***	II	21–24
Holland, Andrew:		
Address by, on acetyline gas as a mine illuminant	II	227–229
Holland, George	IX	34
Holland, W. H.:		
On Ontario nickel industry	III	228, 229
Hollandia lead mine, near Bannockburn, HASTINGS CO., ONT.:		
Notes on by CARTER	VII	156
Holley, Alex. L.:		
Responsible for mechanical improvements in steel-making	IV	25, 26
Holmer mine, LAKE SUPERIOR:		
Analyses	II	50
Holmes, J. A.:		
Quoted on mica occurrence	VII	288
Homes, Geo. S.:		
Prize awarded to	IX	8

* See Summaries, page 51
† " " 4

	Vol.	Page
Homestake mine, ROSSLAND, B.C.:		
Production, 1894-1904	VII	47
Vein	V	522
Hong Kong, *see under* China.		
Hooper pneumatic concentrator:		
Corundum	V	170
Hoover and Mason's excavator:		
Description	III	34
Hopkins, T. C.:		
On origin of Bilbao iron deposits, Spain	IV	203
Hopper, R. T.:		
Discussions by, on:		
A New Mining District in Quebec	VIII	367
The Ore Deposits and Geology of the Sudbury Dist.	IX	230, 231
Elected councillor, 1905	VIII	34
1906	IX	27
Min. refs.	VIII	270
	IX	27
Horan, Prof.	IX	91
Hornblende:		
Boisdale Hills, C.B.	VI	421
Eastern Tps., Que	V	346
Magnetic attractability of	VII	276
Vancouver Island, B.C.	VI	191
Hornblende asbestos, *see* Picrolite.		
Hornblende-biotite-granite:		
Boundary Dist., B.C.	V	366
Hornblende-granite:		
Lardeau Dist., B.C.	VII	90
Sudbury Dist., Ont.	V	529
Hornblende-schists:		
Boundary Dist., B.C.	V	365
Horse Neck, W. VA., U.S.A.	VI	105
Horse-power:		
Dala River, Sweden	II	43
U.S. Geological Survey coal tests	IX	322
Horsefly Dist., B.C.:		
Lead and copper ores	VI	325
Hot springs:		
Origin, notes by HIXON	X	301
Howard copper mine, SUFFIELD, QUE.	V	82
Dyke	V	84
Howe, Prof., H. M.:		
Bursting tests on iron and steel pipe by	VIII	53
Quoted on corrosion of iron and steel	VIII	46
Howe Sound, B.C.:		
Copper occurrence at	IX	44
	X	208
Howley, J. P.	II	67
Howson Creek, TELKWA RIVER, SKEENA, B.C.:		
Self-fluxing ores on	X	222
Huancavelica, PERU:		
Cinnabar mine	II	16
	VI	35
HUDSON, G. S.:		
Shipping Coal by the Aerial Wire Rope System at Port Morien, Cape Breton	IV	131–134

* See Summaries, page 28

	Vol.	Page
Hudson Bay:		
Glacial phenomena	IX	125
Iron ores of	II	39,
	III	192
report by BELL on	II	214
Nastapoka Islands	V	256–264
Navigable season	III	193
Railway to	III	193
Hudson Bay Co.:		
Early coal mining by on Vancouver Island	VI	188
Hudson Bay Mt., SKEENA RIVER, B.C.:	X	221
Hudson Strait:		
Geological survey of	VIII	57
Hull furnace:		
Failure of	II	52
Hull Tp., QUE.:		
Iron ores of	IV	305
	X	110
Mica	VII	304
Humber safety clutch	V	463, 482
Humper No. 1 claim, CONRAD, Y.T.:		
Vein on	X	213
Hundeshagen, L.:		
Quoted on platinum in Western Sumatra	VIII	202
Hungerford, W. A.:		
Discussion by, on:		
The National Importance of Mining	V	135–137
Hunker Creek, Y.T.	III	124
Gold royalties 1900	IV	296
Hunt, Dr. T. Sterry:		
Appointed chemist to Geological Survey	IX	90
Description of occurrence of millerite, Orford Tps., Que	III	224
Discovery of nickel in Canadian ores, by	III	224
Genthite from Michipicoten Island, described by	IX	306
Magnetic concentration of iron sands	VI	12
Quoted on mineral waters, Quebec and Ontario	VIII	89, 97
Reports by, on:		
The Iron Sands of the St. Lawrence	IV	92
Serpentine of Eastern Tps	VI	169
Tribute to work of	VII	409
on the Weight of charcoal from different woods	II	46, 47
Work by on bituminous shales	VI	114
Min. refs	VII	401
	VIII	267
Hunter, J. C.:		
Iron mining operations, Atikokan	IX	300
Hunter's Basin, TELKWA RIVER, B.C.:		
Mineral locations in	X	222
Hunter's Island, RAINY RIVER DIST., ONT.	VII	154, 257
Iron ore	IV	281, 282
	V	51
Hunting Island, GULF ST. LAWRENCE:		
Pyrite analysis	VI	406
Huntingdon copper mine, QUE.:	VII	398

	Vol.	Page
Huntington mills:		
Coeur d'Alene dist., Idaho	IV	262
Crushing with, notes by PORTER	IV	212, 214, 218
DEKALB, notes by	IV	190
at McGill University	IV	205
Slocan Dist., B.C.	VI	153
Use in re-crushing middlings	IV	263
Huntley Tp., CARLETON CO., ONT.:		
Rocks in	VII	289
Huron Copper Bay mine, BRUCE MINES, ONT.	VII	144,
	X	149, 151
Huronian:		
History, notes by BELL	X	62
Rock movements, paper by MILLS	VII	177–184
Zinc occurrences in	VII	156
Mexico:		
Oaxaca	VIII	273
New Brunswick:		
St. Stephen	IX	239
Ontario:		
Atikokan	IX	287
Bruce mines	X	157
Cobalt Dist., relation of ores to	X	49
Lake Huron, north of, iron ores in	VII	258
Larder Lake Dist.	X	69
Michipicoten iron range	VII	259
Nipissing Dist.	IV	275
jaspilyte in	IV	279
Rainy River	VII	125
Sudbury Dist.	V	528
Sultana lode	II	88
Thunder Bay Div.	VIII	184
Western	V	50
iron ore deposits	V	51
notes by BRENT	VI	327
Quebec:		
Chibougamau Dist.	VIII	363
Sweden:		
Central	II	40
United States:		
Minnesota	VII	336
Huronian gold mine, Moss TP., TH. BAY, ONT.	VII	124, 132
Hutton iron range, ONT.	VII	257
Hutton Tps., SUDBURY DIST., ONT.:		
Iron ores of	VII	154
Jaspilyte	IV	278
Hydraulic cement, *see* Portland Cement.		
Hydraulic classifier:		
Factor of surface friction	III	108
Helena Frisco mill, Idaho	IV	255
Hydraulic gold mining:		
British Columbia:		
Cariboo Dist.	X	418
In 1900	IV	294
Omineca Div.	X	228
Quebec:		
Chaudiere, possibilities	IV	9

	Vol.	Page
Hydrocarbon(s), *see also under separate headings.*		
Acetylene	VI	75
Albertite	VI	106
Analyses	VI	77
in Coal dust and fire damp	VI	202
Deposition of ores, effect of on	X	56
Gases, from lava	VI	82
Spiegeleisen	VI	124, 126
Hydrofluoric acid:		
Use in corundum determination	IV	180
Hydrogen:		
Calorific power	IV	135
Coking coals, free in	VIII	238
Fire-damp:		
Constituent of	VI	202
Use as test for	VI	213
Hydro-metallurgical works:		
Republic, Wash	V	279
Hydrostatic theory	III	84, 85
Hydrothermal action:		
Boundary Dist., B.C.	V	371
Hypersthene:		
Sudbury Dist., in nickel-bearing eruptive	IX	231, 232
Hypsometric maps:		
Notes by WHITE	VI	323

I

Iberian Peninsula, *see under* Spain.		
Ice Period, *see also* Glaciation.		
Processes and effects of	III	31
Ida May mineral claims:		
Bridge River Dist., B.C.	III	24, 27
Idaho, U.S.A.:		
Copper mining	IX	54
Idaho claim, TELKWA RIVER, B.C.	X	222
Igneous action:		
Sudbury Dist., Ont., notes by BARLOW	VII	64
Igneous intrusion:		
Butte, Mont.	V	297
Effect on coal seams	VIII	240
	X	224
Relation of silver-lead veins to	V	514
Skeena River, B.C., effect on coal seams	X	224

	Vol.	Page
Igneous rocks:		
British Columbia, south eastern	V	507
Eastern Townships, Que. notes by DRESSER	V	81 et seq.
Grain of	IX	210
Hydrocarbons in	VI	76 et seq.
Salmon River Dist., B.C.	III	4
Texada Island, B.C., intrusion of	X	243
West Kootenay, B.C.	II	74
Illinois:		
Depth of glacial grist	III	30
Illuminants:		
Acetylene	II	227–9,
	IX	404
Benzolene in safety lamps	VI	207, 208
Water gas	VIII	299
Illuminating oil, *see* Petroleum.		
Ilmenite:		
In Gabro, diagram	IX	296 (opp.)
Greenwater Lake, Ont.	V	59
Magnetic permeability of	VI	11
Imperial Development Syndicate, NELSON, B.C.	VII	95
Imperial Oil Company, SARNIA, ONT.:		
Exhibit, Buffalo Exhibition	V	254
Notes by COSTE on	X	80
Import duties:		
Petroleum, removal of	X	80
Imports:		
Graphite, Canada	X	99
United States	X	101
Iron ore, Great Britain	IV	197
IMPROVED METHOD OF INTRODUCING FEED-WATER TO THE STAMP MILL MORTAR, MACDONALD, BERNARD	II	54
	II	102
Discussion on, by:		
ANDREWS, C. F.	II	233, 235
HARDMAN, J. E.	II	232
MACDONALD	II	235, 236
STUART, G.	II	234, 235
†***INDICATOR CARDS,*** HARDIE	VIII	285–289
India, i.e. British East India:		
Bengal:		
mica in	VII	163, 284, 286
Gaya District	VII	286
saltpetre	VI	41
Graphite, statistics	X	101, 102
Hazaribagh	VII	284, 286
Himalayan Mts., formation	VII	286
Madras Province:		
mica, occurrence	VII	286, 287
production, 1902	VII	163
as a Market for Canadian mineral products	VIII	158

* See Summaries, page 6 & 9
† " " 105

	Vol.	Page
India—Con.:		
Mica in:		
Bengal	VII	163, 284, 286
exports, 1900	IV	308
Madras, production, 1902	VII	163
mining	VII	297
occurrence	VII	286, 287
production	V	244
Mining, in notes by WALKER	VI	486
Indian Farm, PINCHER CREEK, ALTA.:		
Coal at	X	236
Indian River, KLONDIKE, YUKON	III	124
Indian Territories, see also Northwest Territories.		
Bitumen	VI	113
Organization of into districts	V	104
Indiana, U.S.A.:		
Diamonds in	IX	124
Gas tests on coals from	IX	325
Glacial drift	III	30
Natural gas, analysis	VI X	101, 79
Oilfields	VI	116
Petroleum horizons	III	82
Steam tests on coals from	IX	322
Indian(s):		
Population, British Columbia	VI	360, 363
Indigo:		
Manufacture	V	145
**THE INFLUENCE OF GOVERNMENT UPON MINING,* KIRBY	VI	355–363
Discussion:		
MACDONALD, BELL, B. T. A., THOMPSON, SHARP, CROASDAILE, KIRBY, CURTIS	VI	363–371
†THE INFLUENCE OF VARYING DEGREES OF SUPERFUSION IN MAGMATIC DIFFERENTIATION, LANE	IX	210–217
Infusorial earth:		
Bass River, N.S.	IV	312
St. Ann's, N.S.	IV	312
Ingall, E. Drew:		
Canadian mineral statistics:		
1898	II	202
1902	VI	455–7
1905	IX	13
Discussions by on:		
A Canadian Department of Mines or Geological Survey	IX	112
Description of the Sultana Quartz lode, etc.	II	241, 243
The Distribution of Platinum Metals	VIII	213
A New and Hitherto Unrecognized Geological Formation in the Gas and Oil Producing Regions of Ontario	II	209, 210, 211

* See Summaries, page 71
† " " 118

	Vol.	Page
Ingall, E. Drew—Con.		
Discussions by on—Con.:		
The Ore Deposits of the Cobalt District, Ont	x	53, 54
The Ore Deposits of Rossland, B.C.	vii	65
Some Mining Camps in the Lardeau Dist, B.C.	vii	111, 112
The Study of Stratigraphy	vii	175
Swedish Iron Metallurgy and its Application to Canada	ii	224
The Utilization of Poor Coals and Slack	ix	330
Notes by:		
Bruce mines	viii	266
Silver Islet	x	88
Report by:		
Graphite, Buckingham, Que.	vi	76
Views:		
Magnetic surveying	vi	477
Method of voting of Institute	viii	10, 11
Minor refs.	vi	462,
	vii	12,
	x	69, 163
Ingersol compressor:		
Compression curves from	viii	288
Ingersoll punching machine for coal cutting	v	108
Ingram Tp., Nipissing, Ont.:		
Cobalt bloom and smaltite in	x	70
Diabase in	x	69
Inostranzeff, Prof.:		
Quoted on platinum *in situ*	viii	201
Inspection of mines, *see* Mine inspection.		
Insolubles:		
Analysis, paper by Lay	v	42–46
Institution of Mining and Metallurgy:		
Definition of "Ore in Sight" by	ix	283
Insulation:		
Steam pipe	v	470
Uses of mica for	vii	301
Intercolonial Colliery, Pictou, C.B.:		
Description	iv	28
Productive coal measures	v	358
Intercolonial Copper Co., Dorchester, N.B.:	v	582
Intercoolers:		
Air compressors	v	157,
	vi	187
International Coal Co.:		
Production, 1901	v	583
International Nickel Co.	vii	148
New Caledonia mines of	vi	175
Inverness, N.S.:		
Coal mining, 1901	v	582
production, 1902	vi	445
Inverness & Richmond Collieries & Railway Co.:		
Broad Cove, N.S.	iv	310,
	v	582
Production, 1901	v	583
Iridium:		
Note by Miller	vi	37
"Iron Cap"		
Boundary Dist., B.C.	v	173

	Vol.	Page
Iron Colt mine, ROSSLAND, B.C.:		
Vein	v	522
Iron Hill, LEADSVILLE	ii	86
Iron Horse mine, ROSSLAND, B.C.:		
Vein, evidence of replacement	v	521, 522
***IRON INDUSTRY IN 1898.** DRUMMOND	ii	57–61
†***IRON INDUSTRY IN 1899.*** DRUMMOND	iii	118–123
Iron Lake, MICHIPICOTEN, ONT	vii	262
Iron Mask mine, ROSSLAND, B.C.:		
Located	v	447
Ore deposits at, notes by KIRBY on	vii	48 et seq.
Production, 1894-1904	vii	47
Vein	v	522
Iron and iron mining:		
ADAMS, paper by on Bilboa deposits, N. Spain	iv	196–204
Analyses of, *see under that title.*		
methods	x	446
Bars, Canadian production and bounty	iv	313
Bessemer grade	vi	7
BIRKINBINE, paper by on reserves and supplies of	x	134–148
Blast furnaces, *see that title.*		
Cast vs. cast steel for crushers	ii	33
"Chirta", origin of	iv	201
Corrosion of, paper by SPELLER	viii	46–58
Electric drills	ii	182
smelting	viii	132–154,
	x	129, 130
experiments	ix	128
Exploring for, methods	vii	263
Concentration of:	x	111
crushing for	vi	11
magnetic, progress of, paper by WELLS	vi	6–20
Grondal process	x	261–273
separation, paper by SNYDER	vii	270–277
Petrographical examination preliminary to	vi	9
Industry:		
in Canada:		
COSTE, notes by on	iv	15
DOUGLAS, notes by on	ii	213
Eastern, early history of	iv	14
effect of free trade on	ii	211
exports, 1901	v	566
1903–04	viii	132
imports, 1900	v	565–566
possibilities of	ii	223,
	vi	313
statistics:		
1898	ii	59
1901	v	565
1902	vi	454–5
Blast furnaces, 1895	ii	60
wages, 1898	ii	60
Germany	ii	58
Great Britain:		
statistics	ii	58,
	iii	118, 119,
	v	132
DRUMMOND, papers by	ii	57,
	iii	118–123

* See Summaries, page 6 † See Summaries, page 21

	Vol.	Page
Iron and Iron mining—Con.:		
Industry—Con.:		
progress during XIX century, notes by MILLER	VI	28
Spain	IV	197
Sweden	II	213, 214, 219
United States	II	52, 220
	III	118
	V	218–217
worlds' statistics of 1807–1900	VI	29
1898	II	59
Interior of the earth composed of	III	196
Loading	IV	66
Magnometric surveying	VII	263
Metallurgy, Swedish, paper by DOUGLAS	II	38–53
notes by SJOSTEDT	II	217
Prices:		
Bessemer pig and charcoal pig compared	II	48
"Hollow Ingot"	II	214
Prospecting for	II	66–71
notes by FORREST	VI	1
Quality of Canadian	II	225
Rolled	II	219
Smelting of low grade	V	132
Standardization of	VI	295
Sulphurous, electric smelting of	IX	133
Testing cast	IV	41–42
Titaniferous, determination	III	120–123
Welding	VIII	296
Wood gas in manufacture of	V	178–182

British Columbia:		
HOBART, notes by on	VIII	159, 160
Industry, prospects for	V	79
Production to 1906	X	185

Kitchener, B.C., paper by BLAKEMORE	V	76–80
Texada Island	X	245
Vancouver Island	V	229
notes by BREWER	VI	199
Labrador Peninsula:		
Hudson Bay:		
Notes by DOUGLAS	II	39, 214
LOW	III	192, 193
Nastapoka Islands	V	257
Ungava Bay	II	39, 214
New Brunswick:		
Royalty on	VII	456
Newfoundland:		
Bounty on	III	194
Notes on by FRASER	IV	26, 27
Prospecting for, paper by MEISSNER	II	66–68
Wabana, Conception Bay	III	120, 122
analysis	IV	63
	V	79
paper by CHAMBERS	III	130 et seq.

	Vol.	Page
Iron and Iron mining—Con.:		
Nova Scotia:		
Boisdale Hills	VI	432
Industry, 1900, notes by BELL	IV	311
1902 FERGIE	VI	448
Production, 1899	III	189
Royalty on	VII	458
Torbrook, paper by PARSONS	IX	31–34
Whycocongh	II	69
Ontario:		
Analysis, Lake Superior	II	50
Exploration in, paper by WILLMOTT	VII	257–265
HILLE, paper by on genesis in Western	V	49 et seq.
Industry:		
History of	IV	265 et seq.
Notes by BELL	IV	301
MILLER, notes by	VI	462,
	VII	381
on Eastern	V	237
paper by	IV	265–283
Shipping facilities	IV	182
Statistics:		
1900	IV	301, 302, 304
1901	V	581
1902	VI	454, 464-5
1903	VII	391, 425, 429
Animikie range, Thunder Bay	VI	245–287
Atikokan Dist	IV	282,
	IX	297
notes by HILLE	V	56
Helen mine, Michipicoten	III	121
	IV	280
notes by CARTER	IV	268
Lake Superior:		
analysis	II	50
	V	79
origin	VII	260
Matawin River	IV	282,
	V	51
Michipicoten Division	II	192
Nipissing District	IV	275
North	IV	271
Northeastern	III	193
Rainy River Dist	V	51
Timagami	III	192
Wallbridge mine	IV	268
Quebec:		
Discovery of	IX	4
Industry, 1898	II	61, 62
1900	IV	305
paper by CIRKEL on possibilities of	X	108–117
Smelting	II	48
Statistics:		
1900	IV	305
1901	V	350

	Vol.	Page
Iron and Iron Mining—Con.:		
Quebec—Con.:		
Chibougamau	VIII	362, 363,
	IX	18, 20
Lake Mistassini (near)	IX	219
St. Lawrence River, iron sands	IV	96
St. Maurice River	II	48
Spain:		
Bilbao Dist., paper by ADAMS	IV	196–204
Sweden:		
Luossarari	II	214
Metallurgy of, paper by DOUGLAS	II	38–53, 213
discussion on	II	217–226
Reserves	II	39
Sandviken	II	219
United States:		
Import duty on	IV	25
Industry:		
1810	II	220
compared with Canadian	II	220
development	IV	26
notes on by DRUMMOND, 1899	III	118
paper on by BIRKINBINE	V	218–227
Statistics:		
1898	II	52, 57
Charcoal pig, 1875-1897	II	52
Ely, Minn., paper by CARLYLE	VII	334
Lake Superior region, origin	IV	25, 274
Minnesota, freight rates on	IV	282 et seq.
Negaunee, Mich	VII	319–334
IRON-BEARING ROCKS OF THE NASTAPOKAN ISLANDS. MICKLE	V	256–264
†***IRON MINING POSSIBILITIES IN THE PROVINCE OF QUEBEC.*** Cirkel	X	108–117
‡***IRON ORE DEPOSITS NEAR KITCHENER, B.C.*** BLAKEMORE	V	76–80
‖***IRON ORE DEPOSITS OF WESTERN ONTARIO AND THEIR GENESIS.*** HILLE	V	49–61
°***IRON ORE FIELDS OF ONTARIO.*** MILLER	IV	265–283
Iron oxide:		
Boundary Dist., B.C.	V	173
Iron pyrites, *see* Pyrite.		
Ontario, notes by CARTER	VII	157
Iron sands:		
Analysis, St. Lawrence River	IV	92, 93, 94
Concentrating and briquetting	VIII	156
Dock Bay, Que	IV	95
Electric smelting of	VIII	137, 153
	IX	132, 134
Elimination of titanium	IV	94
Great Natashquan River, Que	IV	96
Grondal process of briquetting	X	267
Gulf of St. Lawrence	II	62
Magnetic concentration	IV	91
	VI	12

* See Summaries, page 48
† " " 131
‡ " " 41
‖ See Summaries, page 39
° " " 36

	Vol.	Page
Iron sands—Con.:		
St. John River, Que.	IV	95
St. Lawrence River:		
notes by CIRKEL	X	109
available supply	IV	96
North Shore	IV	91–98
origin	IV	92
shipping facilities	IV	97
sketch of locations	IV	96
working season	IV	97
Treatment of	VII	274, 277, 278, 279, 282
	X	270
Utilization and production, Moisie, Que.	VI	91
Iron and Steel Institute:		
Excursion of to United States (1890)	X	136
Irondale & Bancroft Rly.	VII	416
Ironsides mine, PHOENIX, B.C.:		
Mineralization	V	173
Timbering, paper by DEPENCIER	V	424–446
Water power near	X	111
Irrigation:		
Hawaiian Islands	VI	71
Island Falls, MATTAGAMI RIVER, ONT.:		
Formation at	VIII	184
Itacolunite, *see* Diamonds under Precious Stones.		
Italy:		
Apennines, "Salse"	VI	86
Asbestos	V	346
production, 1900, 1901	V	347
Genoa, electro- metallurgical experiments at	V	194
Graphite statistics	X	101, 102
Ivanhoe silver-lead mine, SLOCAN DIST., B.C.:	VII	372
Concentrator	VI	152
Ivigtut, GREENLAND:		
Cryolite	VI	38
I.X.L. mine, SLOCAN DIST., B.C.	V	12
Production, 1894-1904	VII	47

J

JACKES, C. B.:		
****The Economical Treatment of Sulphide Ores***	VIII	244–258
Jackfish, JACKFISH BAY, L. SUPERIOR:		
Gold mining at	VII	124
Sulphide ores in	VIII	244
Jackling, D. C.:		
Gold-milling process, Republic, Wash.	V	279
Jackson concentrator, SLOCAN DIST., B.C.	VI	152

* See Summaries, page 103

	Vol.	Page
Jackson County, NORTH CAROLINA, U.S.A.:		
Nickel deposits in	IX	303–316
Jackson mine, SLOCAN, B.C.	VII	372
JACOBS, E.:		
Discussion by, on:		
The Status of the Mining Profession	X	335
Paper by:		
**Review of Progress in the Mineral Production of British Columbia*	X	183–187
Minor ref.	X	17
Jacobs, Robt.	X	20
Jacquet, J. B.:		
Quoted on platinum occurrence in N. S. Wales	VIII	197
Jagersfontein, *see under* Africa, South.		
James actinolite mine, Actinolite, Ont.	VII	167
James Bay, *see also* Hudson Bay.		
Corniferous rocks of	VII	175
Geological survey of	VIII	57
Gypsum deposits	VII	166
Mineral possibilities of	IX	219
James Lake, TIMAGAMI DIST., ONT.:		
Iron pyrites at	VII	159
Jamesonite:		
Conrad, Y.T.	X	211
West Kootenay, B.C.	II	76
Janes farm, TILBURY, ONT.:		
Oil well on	X	77
January gold claim, GOLDFIELD, NEVADA	VIII	39, 43
Japan:		
Coal production, 1898-1900	VI	31
Copper mining	VI	34
Graphite statistics	X	101, 102
Jesso, coal mines	VI	32
Kiuschiu Island, coalfields	VI	32
Market for Canadian mineral products	VIII	158
Japanese:		
Resident in British Columbia, 1901	VI	363
Jarvis Inlet, B.C.:		
Copper on	X	207
Jasper:		
Deposition	V	60
Greenwater Lake, Ont.	V	52
Lake Superior iron-bearing series	III	192
Matawin River, Ont.	V	52
Nastapoka Island, Hudson Bay	V	256
Jasper conglomerate:		
Occurrence	IX	126
"Jasperoid":		
Goldfield, Nevada	VIII	40
Jaspilite:		
Algoma Dist., Ont.	IV	279 et seq.
Ely, Minn.	VII	337
HILLE, notes by, on	VI	251
Lake Superior Dist., Ont.	IV	271 et seq.
Nastapoka Islands, Hudson Bay	V	257

* See Summaries, page 136

	Vol.	Page
Jaspilite—Con.:		
Nipissing Dist., Ont.	IV	275, 278
Rainy River Div., Ont.	V	51
Thunder Bay Dist., Ont.	IV	281
Timagami Dist., Ont.	IV	278 et seq.
Jeffrey boiler	IV	172
Jeffrey coal cutting machinery:		
Coal Creek colliery	IV	238
Jeffrey electric locomotive:		
Coal Creek colliery, B.C.	IV	238
Jeffrey electric motor	IV	170
Jenkins, H. C.	IX	180
JENNINGS, E. P.:		
**Genesis of the Copper Deposits of Yerington, Nev., The*	X	257–260
†*Goldfield District, Nevada*	VIII	39–45
‡*Leaching Copper Ores by Sulphurous Acid*	IV	123–125
¶*Lost Packer Copper Gold Lode, The*	IX	54–57
Jenny, Walter P.:		
Quoted on occurrence of petroleum in California	VIII	181
Jessie Fraser Mining Company	X	107
Jesso, *see under* Japan.		
Jessop's Point, CAPE BRETON	VI	411
Jette, Sir Louis	IX	24
Jigs:		
Brayton Domain colliery, England	IX	407, 408
Corundum concentration	V	167
Factor of surface friction	III	108
Helena Frisco mill, Idaho, U.S.A.	IV	257
Slocan Dist., B.C.	VI	156
Wesselton diamond mine	V	74
Joachimsthal, BOHEMIA:		
Pitchblende	VI	44
Joe Petty silver claim, WINDY ARM, Y.T.:		
Vein on	IX	50
Joggins, BAY OF FUNDY, N.S.:		
Coal measures	VI	447
Johannesburg, *see under* Africa, South.		
JOHNSON, GEORGE:		
‖*Mineral Production, Canada and United States*	VI	66–72
Min. ref.	VI	473
Johnson, W. S.:		
On ores and rocks of Slocan	II	78
Min. ref.	X	20
Johnson, Matthey & Co.:		
Platinum sponge made by	VIII	193
Johnston, R. C. Campbell:		
Discussion on:		
The National Importance of Mining	V	134–135
Johnstone Strait, VANCOUVER ISLAND, B.C.:		
Formation	VI	195
Joint Stock Companies, *see also under* Mining Legislation, etc.		
Capitalization of France, Germany, Great Britain	IV	245
Issue of shares at discount	IV	79
Laws relating to	IV	244 et seq.

* See Summaries, page 143
† " " 92
‡ " " 27
¶ See Summaries, page 111
‖ " " 61

	Vol.	Page
Jones, R. H.:		
Monograph by, on Asbestos and Asbestic	v	343
Jones' Falls, Rideau Canal, Ont.:		
Graphite in pegmatite	vii	255
Jones and Kincaid	viii	174
Joseph Dixon Crucible Co.:		
Graphite from mines of	x	95
Report by on lubrication	x	97
Josephine iron mine, Michipicoten, Ont.:		
Notes by Willmott	vii	260, 261, 262, 265
Josie mine, Rossland, B.C., *see also* LeRoi No. 2.		
Dyke	v	404
Formation	v	519
Ore deposits at, notes by Kirby	vii	48 et seq.
Vein	v	522
Jubilee mineral claim, Manitou, Ont.	vi	332
Jumbo gold claim, Goldfield, Nevada	viii	39
Jumbo mine, Rossland, B.C.:		
Production, 1894-1904	vii	47
Jurassic:		
Russian oilfields	vi	113
Texada Island, B.C.	x	243
Windy Arm, Y.T.	ix	49

K

Kahn, Paul	ix	4
Kalgoorli, *see under* Australia, Western.		
Kaministiquia, Thunder Bay, Ont.:		
Iron ore deposits	v	51
Pyrite at	x	123
Kamloops Dist., B.C.:		
Cinnabar	ii	14
Kamloops Lake, B.C.:		
Magnetite and chalcopyrite occurrence near	v	371
Kanala, New Caledonia:		
Noumeaite analysis	ix	307
Kananaskis River, Cascade Coal Basin, Alta.	viii	225
Cretaceous plateau, sketch of by Dowling	viii	228
Kaolin:		
Boundary Dist., B.C.	v	369
Karpattie Mts., Galicia:		
Oilfields	vi	101, 108
Karren structure:		
Alps	iv	201
Kartar Bay, Alaska:		
Copper mining at	x	204
Kasaan Peninsula, Alaska:		
Copper on	x	202
mining	x	204

	Vol.	Page
Kaslo-Slocan Railway	VI	147
Keating, (?):		
Discoverer, Bruce mines	X	149
Keating location, BRUCE MINES, ONT.	X	149
Keepsake iron claim, KITCHENER, B.C.	V	77
Keewatin, RAINY RIVER DIST., ONT.:		
Reduction works at	I	10
Keewatin formation:		
Atikokan, Ont.	IX	287
Cobalt Dist.	X	49
Diamonds in	III	159
Eastern Tps., Que.	V	84
Goudreau Lake, Ont.	X	122
Iron in	V	56
Lake of the Woods, Ont.	X	63, 67
Rainy River Div., Ont.	VII	125
Western Ontario, notes by BRENT	VI	327
rocks	V	50
Keewatin gold mine (near) RAT PORTAGE, ONT.:		
Vein, description of	II	239–240
KEFFER, FREDERICK:		
Elected president, 1907	X	17
vice-president, 1906	IX	26
Papers by:		
**Emma mine, The*	X	188–194
†Method of Mining Low Grade Ores in the Boundary Creek District, A	V	213–217
‡Notes on Diamond Drilling in the Boundary District	IX	317–320
¶Notes on Mining and Smelting in Boundary District, B.C.	VII	42–46
Min. refs.	VI	440,
	X	53
Keller, Dr. Edward :		
on Distribution of impurities in copper material	II	109
Uniformity in composition of anodes cast from pigs	II	115
Minor reference	VIII	133
Keller electric furnace:		
Construction of	VIII	139
Kelly, W.:		
Address at Halifax meeting of Institute	IV	57
On testing wire rope	IV	43
KEMP, DR. JAMES F.:		
Discussion by, on:		
Magmatic Waters	X	310, 315
Paper by:		
‖*Some New Points in the Geology of Copper Ores*	X	251–256
Quoted on:		
Garnet zones	X	178
Origin of pyrite	X	120
Platinum distribution	VIII	194, 198, 199, 202, 204, 210

* See Summaries, page 137
† " " 46
‡ " " 124
¶ See Summaries, page 74
‖ " " 142

	Vol.	Page
KEMP, DR. JAMES F.—Con.:		
Work of, in Tulameen Dist., B.C.	VIII	200
Min. refs.	VIII	20,
	X	17, 19, 280
Kendall, J. D.:		
Reference to paper by on "ore in sight"	IX	283
Kent, William:		
Quoted on graphite for lubrication	X	97
Kent Co., ONT.:		
Oil horizon in	VII	175
Kent mica mine, FRONTENAC CO., ONT.	V	244
Kentucky, U.S.A.:		
Coal, geological age of	VII	500
Kerosene:		
Cleaning valves with	V	160
KERR, D. G.:		
Air Compression by Water-power.—The Installation at the Belmont Gold Mine.	VI	233–244
Kerr, John:		
Petroleum found on farm of	X	77
Kertch, CAUCASUS MTS.:		
Mud volcano	VI	86
Kettle Point, LAKE HURON:		
Shales	II	186
Kettle River, YALE DIV., B.C.:		
Coal analysis	VI	226
coking	VI	229
Copper ore	V	365 et seq.
Mineralized areas on north fork of	X	170
Keweenawan formation:		
Michipicoten, Ont.	VII	263
Minnesota	VII	336
Western Ontario	V	50
Keweenaw Peninsula, LAKE SUPERIOR:		
Copper deposits	X	399
Key West mine, BUNKERVILLE, NEVADA:		
Platinum in ores from	VIII	206
Keystone Graphite Company	X	92
Keystone silver mine, THUNDER BAY, ONT.	VII	141
Kiddie, Thomas:		
Elected councillor, 1906	IX	27
"Kieslager"	X	254
Kibei, MAUI ISLAND, HAWAII:		
Pumping station at	VII	78
Kiirunavaara, *see under* Sweden.		
Kiln:		
Sulphuric acid mfg.	VI	393
Kimberley, B.C.:		
Silver-lead ore	V	512
Kimberley, CAPE COLONY, *see under* Africa, South.		
King, Clarence:		
On mining statistics	V	123
Views on East Ridge fault, Butte, Montana	V	298
King, James:		
Death of	IV	288

* See Summaries, page 66

	Vol.	Page
King, Col.:		
Death of	VII	3
King claim, TELKWA RIVER, B.C.	X	222
King County, NEW BRUNSWICK:		
Albertite	VI	113
King of the North Gold Mines Company	X	107
King Solomon mineral claim, BOUNDARY DIST., B.C.:		
Copper ore deposit	V	375
Kingsbury, Prof. Albert:		
Quoted on the friction of screws	X	97
Kingsley, George Edward:		
Process of, for treating sulphide ores	VIII	246
Kingsley Brook, DUDSWELL TP., QUE.:		
Placer gold in	VIII	260
Kingston, Ont.:		
Anthraxolite	VII	253
Corundum belt	III	200
Institute meeting at, 1904	VIII	5
Iron ores	II	225
	IV	268
Mica industry	V	245
Organization of Branch of C.M.I. at, 1902	V	606
Water power	III	139
Zinc occurrence near	VII	156
Kingsville, Ont.:		
Petroleum	II	208
KIRBY, EDMUND B.:		
Elected vice-president ,1904	VII	22
Papers by:		
**Influence of Government on Mining, The*	VI	355–371
†Ore Deposits of Rossland, B.C., The	VII	47–58
Min. refs.	VI	439, 440
KIRKEGAARD, P.:		
‡The Harris System of Pumping by Compressed Air, as applied at the Deloro Mine,	V	265–273
¶Treatment of Auriferous Mispickel Ores	IV	113–122
Kirkpatrick, Prof. S. F.:		
Discussions by, on:		
Attraction of Minerals for Residuum Oil	VII	188, 191
British Columbia Zinc Problem	VII	375
Dry Ores of the Slocan	VII	207, 208
Electric Smelting	VIII	155
Kispyox River, SKEENA DIV., B.C.:		
Coal discovery	X	223
Kitamat Development Co.:		
Goat Creek ,Skeena Div., B.C.	X	226
Kitchener, B.C.:		
Iron deposits, paper by BLAKEMORE	V	76–80
Kitsalas Canon, OMINECA DIV., B.C.:		
Gold-copper ores	X	228
Kitsequecla River, SKEENA RIVER, B.C.:		
Coal discovery	X	223
Rocks on	X	220
Kiuschiu Island, *see under* Japan.		

* See Summaries, page 71
† " " 71
‡ See Summaries, page 49
¶ " " 27

	Vol.	Page
Kjellin electric furnace:		
Description of	VIII	144
Klepetko, F.:		
Furnace patent	VI	306
Klondike, Y.T., *see also under* Yukon *under* Gold.		
Conditions, 1900	III	210, 211
Gold in:		
estimate	III	213, 214
occurrence	III	216
production	VI	342
report on, by Geological Survey	IX	97
McCONNELL, paper by on geology	III	124–7
discussion	III	209–17
Payable gravel	III	212
Quartz mining possibilities	III	12
Roads	III	210
Royalties	III	211–215
Values in bed rock	III	211
bench and creek gravels	III	212
quartz drift	III	210
WADE, notes by, on	V	598
Klondike series:		
Similarity of rocks in Eastern Tps., Que., to	V	84
Knee Hill, ALTA.:		
Coal mining	V	108
Knee Hills Creek, ROSEBUD DIV., ALTA.:		
Coal at	X	236
Knight, Cyril W.:		
Awarded President's gold medal	VIII	2, 21
Papers by:		
**Microstructure of Nickeliferous Pyrrhotite*	X	274–280
†*Notes on Some Deposits in the Eastern Ontario Gold Belt*	VII	210–244
Knight, (?):		
Platinum precipitated by	VIII	193
Knight & Stone	IX	389
Knight's Island, ALASKA:		
Copper on	X	199, 207
Knight's shaft, BRUCE MINES, Ont.	X	159
Knob Hill mine, PHOENIX, B.C., *see also* Ironsides mine.		
BROCK, notes by on	VII	45
CORLESS, notes by on	V	517
Hoist at, plan	V	444, 445
Mineralization	V	173
Mining, 1901	V	176
Timbering, paper by DEPENCIER	V	424 et seq.
Knowles pump:		
Operating results	III	128–129
KOEHLER, W.:		
‡*Electrolytic Production of Metals, with Special Reference to Copper and Nickel*	V	189–212
Discussion	V	393 et seq.
Kohlrausch, F. & W.:		
Researches, electro-metallurgy	V	192
Kokanee creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11

* See Summaries, page 144
† " " 80
‡ See Summaries, page 46

	Vol.	Page
Kokoka Lake, TIMAGAMI DIST., ONT.:		
Jaspilyte	IV	278
Kolbeck, Prof.	VIII	209
Konigsberg silver mine, *see under* Norway.		
Kootanie series:		
Quality of coal found in	X	230, 232
Rocky Mts., coal-bearing formation	VIII	221
Kootenay-Columbia Mt., W. KOOTENAY, B.C.:		
Formation	V	519, 520
Vein	V	522
Kootenay, East, B.C.:		
Mining, 1900	IV	295
ROBERTSON, notes by	V	573
Quartzites	V	507
Silver-lead ores, notes by FOWLER	VI	151
Kootenay Lake, B.C.:		
Formation	VI	148
Rocks	V	506
Kootenay Pass, B.C.:		
Coal measures	VI	232
Kootenay, West, B.C. *See also* Lardeau, Nelson, Rossland, Slocan, etc.:		
Ore bodies, paper by Brock	II	72–86
Kopparberg, *see under* Sweden.		
Korza, *see under* Sweden.		
Kristiana District, *see under* Norway.		
Krivoi Rog, *see under* Russia.		
Krohnke silver process	VII	200
Krom separator:		
Graphite concentration	X	92
Krupp ball mill:		
Note on by DEKALB	IV	190
Kunz, G. F.:		
On diamonds in California	III	151
Min. refs	IX	124
Kurdestan Mts., PERSIA:		
Oilfields	VI	108
Kurita, (?):		
Quoted on Shansi coalfields	VIII	113

L

La Baie du Febvre Seigniory, QUE.:		
Mineral springs	VIII	91
Laboratories:		
Construction, notes by LEDOUX	VI	471
Canada Iron Furnace Co., Midland, Ont.	VI	296
Philadelphia commercial museum	VI	320
Labelle County, QUE.:		
Graphite mining in	X	90
occurrence	X	86

	Vol.	Page
Labour:		
Anthracite breaker, Pacific Coal Co.	IX	270
Canadian iron industry, 1898	II	60, 61
Charging of in "Cost Accounts"	III	39, 40
in Coal mines	IX	200 et seq.
Legislation:		
Eight-hour day for miners, British Columbia	III	168, 171, 172
Roasting plant	VII	487
Unions:		
Responsibility of, FERGIE'S views on	VI	450
R. G. LECKIE on	VI	451
Alberta:		
Colliery, Lethbridge, Alta.	V	109
British Columbia:		
Boundary Dist., Mother Lode mine	IX	351
East Kootenay:		
Coal Creek colliery	IV	172, 173
Eight-hour legislation	III	168, 171 172
Mines, conditions, 1899	III	183
1906	X	186
Nelson, Hall mines	III	173
Rossland:		
Carpenters	VI	136
Conditions	V	319, 323, 324, 478, 479
Contract system	V	414
LeRoi mine, costs	V	316
Slocan Dist.:		
Concentrating mills	VI	159
Troubles	V	574
Cumberland, Eng.:		
Coal mine	IX	410
India:		
Mica mines	VII	163
Mexico:		
By contract in mines	VIII	278, 279
New Caledonia:		
Nickel mines	VI	179
Nova Scotia:		
Collieries, 1902	VI	447
Gold mining	II	164
	IV	45
Nova Scotia Steel Co.	IV	35
Ontario:		
Bruce mines	X	152
Iron industry, 1898-1900	IV	302
Mica mines	VII	163
Mining industries 1900	IV	303
Nickel industry	III	229
Quebec:		
Asbestos mines	V	355
South Africa:		
Shaft sinking	II	245

	Vol.	Page
Labour—Con.		
Spain:		
Quicksilver mines	II	16
Sweden:		
Iron industry	II	223
United States:		
Iron industry, prior to 1840,	V	220
Minnesota	VII	366
Yukon:		
1900	III	210
Labrador:		
Possibility of finding diamonds in	IX	124, 127
Pyrite	VI	391
Lac du Bonnett, MANITOBA:		
Brick manufacture	V	579
Lac des Milles Lacs, THUNDER BAY, ONT.:		
Formation at	VIII	184
Lac Seul, ONT. & KEE:		
Molybdenite occurrences	VII	165
Lace diamond mine, ORANGE RIVER COLONY, S. AFRICA	V	62
Lacey mica mine, BOROUGH TP., FRONTENAC CO., ONT.:		
Crystals, size of	VII	427
Notes on by CORKILL	VII	292
Lackawanna Coal Co.:		
Cement for shaft lining used by	VII	434
Lady McDonald nickel mine, SUDBURY, ONT., *see also* McAllister mine.		
Sale of	VII	497
Ladysmith, VANCOUVER ISLAND, B.C.	VI	196
Copper near	VIII	174
Lake Abitibi, QUE.:		
Gold at	X	107
Mineral possibilities	IX	219
Lake Askikwaj, QUE.:		
Huronian rocks on	X	103
Lake Assinibastot, CHIBOUGAMAU, QUE.:		
Cobalt bloom near	X	105
Lake Chibougamau, QUE.	VIII	363
Minerals discovered near	IX	218
Lake Dore, CHIBOUGAMAU, QUE.:		
Copper near	X	105
Lake Farquhar, HALIBURTON CO., ONT.:		
Scenery and formation at	VII	178, 179
Lake Huron, ONT.	VII	143
Copper mining	X	149
Formation north of	VII	258
Glaciation	IX	126
Gold mines, notes by Carter	VII	121
Salt deposits east of	VII	428
Lake Kewagama, ABITIBI DIST., QUE.:		
Huronian rocks on	X	106
Molybdenite reported at	X	106
Lake Luossajarvim, *see under* Sweden.		
Lake Manitoba, MANITOBA:		
Gypsum deposits	V	578

	Vol.	Page
Lake Megantic, Que.:		
Formation at	VIII	260
Rocks at, notes by Dresser	VII	398
Lake Nipissing, Ont.:		
Molybdenite	VI	49
Lake Obatogaman, Que.:		
Huronian formation at	VIII	363
Lake Opasatica, Que.:		
Huronian rocks on	X	106
Lake Palici, Sicily	VI	83
Lake St. Clair, Ont.:		
Salt deposits east of	VII	428
Lake St. John, Tache Tp., Que.:		
Rare minerals found near	IX	73
Trail to Chibougamau from	X	106
Lake St. Martin, Manitoba:		
Gypsum	IV	299
Lake Superior, Ont.		
Copper region	II	108,
	VI	34,
	X	399, 400
Glaciation	IX	126
Gold mining	VII	122
Iron, analyses	II	50
ranges	IV	271,
	VII	257
notes by Van Hise	VI	248
Lake Superior Power Co., Sault Ste. Marie, Ont.:		
Exhibit Buffalo Exhibition	V	254
Helen hematite mine, Michipicoten, opened by	IV	301
Iron ore production, 1900	V	565
Water gas plant of	VIII	293
Min. ref.	III	121
	VII	425
Lake Superior, U.S.A.:		
Iron reserves	X	141
Lake Timagami, Ont.:		
Iron ores	III	192,
	IV	277, 278
Lake Timiscaming, Ont.:		
Iron ores	IV	277
Lake Wahnapitae, Hutton Tps., Ont.	IV	277
Copper ores	VII	146
Jaspilyte	IV	278
Nickel	V	528
Lake Wakonichi, Que.:		
Rocks near	IX	19
Lake of the Woods, Rainy River Dist., Ont.:		
Gold mining, 1900	IV	302
	VII	124
notes by Carter	VI	327 et seq.
ores, notes by Brent	II	239
Maiden Island	II	241
Ophir mine	II	239
Pine Portage mine	VIII	186,
Rocks in	X	63, 67
	II	87
Sultana mine		

	Vol.	Page
Lakes, Prof. Arthur:		
Report by on volcanic dykes	VI	77
Lala River, *see under* Russia.		
LAMB, H. MORTIMER-:		
Elected secretary of Institute, 1905	VIII	34
1907	X	17
Note by, on membership classification	X	13
Paper by:		
****On the Advisability of the Establishment of a Federal Department of Mines***	IX	87–106
Report as secretary	X	4
Minor references	IX	1, 7, 22
	X	20
Lambton County, ONT.:		
Petroleum in	VII	427
Lamp(s) (FOR COAL MINES):		
Ashworth's	V	390
British regulations respecting	V	379
Chesneau's gas-testing	V	212
Clanny	VI	201
	IX	385
Conditions under which use is dangerous	IV	166
	V	379
Davy	VI	212, 213
	IX	385
effect of fire-damp on	V	379
Down current unsafe	V	390
Hepplewhite-Gray	V	390
	VI	200
Marsany double gauze	V	383
Mueseler	VI	200, 380
Protector	IX	404
Stevenson	V	379
Stokes	VI	206
Wolf	VI	201, 386
Lampadite:		
King Solomon mine, Boundary Dist., B.C.	V	375
Lamprophyric dyke:		
Rossland district, B.C.	V	523
Lanark County, ONT.:		
Graphite in	X	86
mining	VI	161
Hematite	IV	268
Mica mining in	VII	163
occurrences	VII	289
Pyrite deposits	X	125
Lancaster, OHIO:		
Oil and natural gas	III	82
Lancaster County, PENNSYLVANIA:		
Nickel	IV	184
"Nickel-Gymnite"	IX	306
Land Grant, *see* Subsidies.		

* See Summaries, page 113

	Vol.	Page
Landlocked Bay, ALASKA:		
Copper at	X	199
LANE, ALFRED C.:		
The Influence of Varying Degrees of Superfusion in Magmatic Differentiation	IX	210–217
Notes by on Michigan Limestones	V	47
"Lang lay"		
Wire rope	V	38
La Place:		
Theory of, on composition of Earth's interior	III	196
Lapparent, A. de:		
Quoted on volcanic phenomena	VI	87, 88
La Praz, *see under* France.		
Laramie formation, *see also* Edmonton.		
Belle Plain, near Regina, Sask.	VIII	241
Coal:		
analysis	VII	424
areas	X	234
fuel ratio,	X	236
quality	X	230
Crowsnest Pass, B.C.	IV	156
Cypress Hills, Sask	X	235
Saskatchewan	V	105
Western Alberta	VII	422
Lardeau District, B.C.:		
Geology and mining camps of, paper by BROCK	VII	87–111
Larder Lake Dist., ONT.:		
Geology of, notes by PARKS	X	69
Lardo, KOOTENAY LAKE, B.C.	VII	87
La Rose silver mine, COBALT, ONT.:		
Depth of	X	56
Vein of:		
graphite in	X	58
notes by BELL	X	66
Last Chance Creek, KLONDIKE	III	124
Last Chance mine, SANDON, B.C.	II	84
LATHE, FRANK E.:		
†***Basic Open-Hearth Steel Manufacture as Carried Out by The Dominion Iron & Steel Co., Sydney, C.B.***	X	373–396
Min. ref.	X	130
Latimer, F. H.:		
Discussion on:		
Description of Sultana Quartz Lode	II	241
La Touche Island, PRINCE WILLIAM SOUND, ALASKA	IX	44, 45
Copper on	X	201, 202, 206
Launders:		
For solution in front of ore tanks	IV	120
Laurentian formation:		
Economic minerals in, notes by MILLER	VII	378
Gold veins in	VII	124

* See Summaries, page 118
† " " 147

	Vol.	Page
Laurentian formation—Con,:		
Ontario:		
Atikokan	IX	287, 289
Eastern, notes by HILLE	VI	258
Frontenac Co.	VII	215
South-eastern iron fields	IV	267
Western	V	50
notes by Brent	VI	327
Quebec:		
Chibougamau Dist.	VIII	363
Montreal Island	VIII	85
St. Lawrence River, iron sands	IV	95
Rock movements, paper by MILLS	VII	177–184
Webster, N. Carolina	IX	311
Laurier, Sir Wilfrid:		
Patron of Institute	II	252
Views on mining legislation	VII	30
Minor refs.	X	5
Lava:		
Emanations from	VI	81, 82
Notes on by HIXON	X	302
Water in	X	303
Law of Apex:		
Ontario and British Columbia, abolishment of	III	112
Lawson, Dr. A. C.:		
On diamonds in Keewatin rocks, Rainy Lake region	III	159
On geology of Thunder Cape, Ont.	III	160
Report by on petrography of Laurentian rocks, ref. to.	VI	259
Lawson silver mine, COBALT, ONT.:		
Diabase on	X	67
Laxton Tps., VICTORIA CO., ONT.:		
Molybdenite	VI	50
LAY, DOUGLAS:		
****Analysis of Insolubles***	V	42–46
†***Determination of Lead in Ores by Fire Assay***	IV	224–229
LeRoi mine, ROSSLAND, B.C.:		
Air compressing plant	VI	182
Cement for construction work at	VII	433
Compressed air signalling at, paper by MACDONALD & THOMPSON	VI	161–168
Costs of operation	V	312 et seq., 337, 340, 341
Country rock	II	74
Development	III	80, 164
Drilling at	IX	388
Effect of 8-hour law at	V	319
Formation	V	519
Head frame	V	467
History	V	310 et seq.
Hoisting and haulage plant, paper by MACDONALD	V	309–342
Located by Moris & Bourgeois	V	447
Method of mining at	V	410
Ore deposits at, notes by KIRBY	VII	48 et seq.
examined for platinum	VIII	206
values and mining costs, notes on, by MACDONALD	V	310–323

* See Summaries, page 39
† " " 33

	Vol.	Page
LeRoi mine, ROSSLAND, B.C.—Con.:		
Organization	v	310, 312
Production, 1894-1904	vii	47,
	v	312
1900	v	324
Shaft	v	328
	vii	85
Timbering at, paper by MACDONALD	vi	129–141
Vein	v	522
		523, 524
Water Supply	v	475
***LEROI MINE, ROSSLAND, B.C.,** HALL	v	403–423
LeRoi Mining Co.:		
Agreement with BREEN	v	311
Purchase of Breen interest, Northport smelter	v	323
LeRoi Number 2 mine, ROSSLAND, B.C.:		
Production (1894-1904)	vii	47
THOMPSON, note by on	vii	197
LeROY, O. E.:		
†*The Marble Bay Copper Deposit*	x	242–250
Minor references	vi	411,
	x	215
La Societé Nickel, NEW CALEDONIA	vi	175
LEACH, W. W.:		
Paper by:		
‡*Some Notes on the Economic Geology of the Skeena River*	x	218–228
Report by on Blairmore coalfields, Alta.	vii	423
Min. ref.	x	171
Leaching:		
Bromo-cyanide process	iv	143
Copper, Butte, Montana	v	298
Copper sulphide ores	v	197
Formula for calculating diameter of ore particles	ii	10
Gold ores, Republic, Wash.	v	284
Neill process	iv	123, 124
Plant, Deloro, Ont.	iv	121
Testing solution for zinc boxes	iv	147
¶*LEACHING COPPER ORES BY SULPHUROUS ACID,* JENNINGS	iv	123–125
Lead and lead mining:		
Assaying, notes on by LAY	iv	224–229
by fire, not reliable	iii	171
Bounty on	iv	313
	viii	159
Canadian statistics, 1901	v	569
1902	vi	454, 455
1906	x	12
Kingsley process of reducing	viii	246
Market for in Orient	viii	159
Royalty on in Maritime Provinces	vii	456
Smelting	viii	119, 120
	ix	58
Volatility of	iv	229

* See Summaries, page 55
† " " 141
‡ See Summaries, page 139
¶ " " 27

	Vol.	Page
Lead and lead mining—Con.:		
British Columbia:		
Industry, 1900	IV	293, 295
Statistics, 1900–1	V	572
1902	VI	453
to 1906	X	183, 185
East Kootenay:		
North Star mine	V	512
St. Eugene	V	512
Nelson Dist.:		
Ymir mine	III	9,
	V	525
Slocan Dist.:		
notes by Fowler	VI	148
percentage of in ores	III	13
silver with	III	170
Ontario:		
Mines, notes by CARTER	VII	155–157
Occurrences, notes by MILLER	VII	383
Statistics (1903)	VII	392, 429
Quebec:		
Industry (1901)	IV	308
Wright, Lake Timiskaming	IV	308
Yukon:		
Conrad	X	211
Leadville, COL., U.S.A.:		
Copper at	X	255
Silver at	X	57
mining	VI	33
Zinc treatment	VII	376
"Leadville problem"	VII	274
Leamington, ONT.:		
Petroleum	II	208
Leases, mineral lands, *see also* Mining laws.		
British Columbia, placer claims	VII	452, 459
New Brunswick, provisions	VII	456
Nova Scotia, provisions	VII	457
Ontario	VII	453
LECKIE, MAJOR R. G.:		
Discussions by on:		
The Advisability of the Establishment of a Federal Department of Mines	IX	21, 22
Economic Geography	VI	466
The Geological Survey as an Educational Institution	VII	447
A New Area of Copper-bearing Rocks in the Eastern Townships of the Province of Quebec	VII	400
The Old Valley Gravels of the Klondike	III	210-213
The Pioneer Iron Mine, Minn.	VII	367
Some Laboratory Experiments in Making Steel in the Electric Furnace	IX	134
The Stewart River Gold Dredge	VI	469
Suggested Improvements to the Mining Laws in Canada	VII	466, 472, 477
The Utilization of Poor Coals and Slack	IX	327 et seq.
The Volcanic Origin of Natural Gas and Petroleum	VI	473, 474

	Vol.	Page
LECKIE, R. G.—Con.		
Elected Councillor C.M.I., 1898	I	18
1904	VII	22
Vice-President, 1906	IX	26
Notes by:		
On the nickel industry of Ontario	III	224–226
On the progress of the Institute	VI	451 et seq.
On shaft-lining	VII	434
Papers by:		
**Nickel Deposits in New Caledonia*	VI	169–179, 483
†*On the Nickel Deposits of Norway*	VII	401–409
Views on computation of mineral statistics	VI	459
Minor references	VI	484, 485
	IX	24, 25
Leckie iron mine, TORBROOK, N.S.:		
Iron analysis	IX	33, 34
Shaft at	IX	31
LEDOUX, DR. A. R.:		
Discussions by, on:		
The Gold Measures of Nova Scotia and Deep Mining	II	247
The Modern Blast Furnace Laboratory	VI	471
The Status of the Mining Profession	X	323
Notes by on smelting costs in Boundary Dist., B.C.	VI	225
Papers by:		
‡*Notes on the Oregon Nickel Prospects*	IV	184–189
¶*Production of Copper in the Boundary District, The*	V	171–177
‖*Richness of Cobalt Ores*	X	72–73
°*The Sampling of Argentiferous and Auriferous Copper*	II	108
Welcomed by Institute	VI	470
Leduc mica mine, WAKEFIELD, QUE.:		
Notes by OBALSKI	VII	304, 307
Leech River, VANCOUVER ISLAND, B.C.:		
Gold discoveries	VI	189
Leeds Tps., MEGANTIC CO., QUE.:		
Molybdenite	VI	50
Serpentine in	VIII	269
Legislation, *see also* Mining Legislation.		
Affecting engineering profession	V	561
Companies' Act, Great Britain, 1900	IV	246
Crow's Nest Pass Coal Co., subsidies to	IV	237
Leipsigate Dist., N.S.:		
Gold milling in	VII	318
Leith, Prof. C. K.:		
Address by, on iron deposits of the Mesabi District	VI	462
Quoted on origin Lake Superior iron	VI	278
Lemon Creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11
Lenora copper mine, MT. SICKER, B.C.	VI	194
	IX	46
	X	204

* See Summaries, page 63
† " " 86
‡ " " 31
¶ See Summaries, page 44
‖ " " 128
° " " 9

	Vol.	Page
Leon, *see under* Spain.		
Leonard, H.	II	25
LEONARD, R. W.:		
†***Notes on Concrete***	VIII	102–110
Minor ref.	X	14
Lepidolite, *see also* Mica.		
Leduc mine, Que.	VII	304
Occurrence	VI	44
Lepreau Harbour, BAY OF FUNDY, N.B.:		
Graphite at	X	86
"Leptocelia Intermedia"	II	210
Lethbridge, ALTA.:		
Alberta Railway & Coal Co., coal mines	V	108
Belly river series at	VIII	221
Coal, analysis	V	106,
	VII	424,
	VIII	237
available supply per square mile	V	112
character of	V	106
fuel efficiency of	IX	325
mines	V	108
production, 1902	VI	454
quality of	V	106,
	VI	225,
seams	X	233
Geology	VII	422
Labour	V	109
Lethbridge coal mine, ALTA.:		
Haulage	VI	373
Lethbridge & Great Falls Railway	IV	170
Lesley, J. P.:		
Views on impermeability of strata in oil regions	VI	116
Leverett, Frank	IX	124
Lewis, Prof. Carvill:		
On geology of the Kimberley diamond field	III	156
Platinum researches of	VIII	193
Lewis, George:		
Discussion by, on:		
Acetylene Gas as a Mine Illuminant	II	230
LEWIS, J. F.:		
Address of welcome to the Institute	IV	4
****Chicago Main Drainage Canal, The***	III	30–36
Death	V	557
Lewis, V. B.:		
Experiments by to determine amount of air to be mixed with coal gas previous to combustion	IV	139
Lexington Creek, LARDEAU DIST., B.C.	VII	93
Lexington Mt., FISH RIVER, LARDEAU, B.C.:		
Gold ores on	VII	95
Libbey, W. L.:		
Address by at Halifax meeting of Institute	IV	49
Elected Councillor, C.M.I., 1898	I	17
Library of Institute, *see under* Canadian Mining Institute.		
Libyan desert:		
Artesian wells	VIII	83

* See Summaries, page 96
† " " 16

	Vol.	Page
Lievre River, Labelle County, Que.:		
Graphite milling at	X	92
Uranite	IX	72
Life insurance:		
Capital invested in Canada	VIII	111
Lighting, *see also* Illuminants, Electric lighting, etc.		
Centre Star mine, Rossland, B.C.	V	467
Coal Creek colliery, B.C., system at	IV	166
Knob Hill-Ironsides mines, Phoenix, B.C.	V	432
Lignite, *see also* Coal.		
as Fuel in smelting	IX	328
Gas from	IX	325, 328
in Producer gas engine, notes by Dowling	IX	321 et seq.
Manitoba:		
Consumption and price in, 1899-1900	IV	299, 300
Gas-producer plant, Brandon	IX	324
Prices	V	578
Ontario		
Notes by Gibson	VII	393
Saskatchewan:		
Roche Percee	IV	299,
	V	578
Yukon:	III	212,
	V	576
Cliff Creek	IV	296
Rock Creek	IV	296
Likely Gulch, Quesnelle Lake, Cariboo Dist., B.C.	X	418
Lillooet District, B.C.:		
Discovery of gold in	III	21
Lima, Ohio		
Petroleum	X	80
Lime:		
Analysis, Philipsburg, Que.	V	48
Boisdale Hills, C.B.	VI	431
Carbonate, uses	V	47
Charge of:		
in arrastras	VIII	275
electric furnace	VIII	141–2–3
Determination of	VI	294
Ontario, production:		
1893–1903	VII	392
1900	IV	304
1902	VI	464, 465
1903	VII	430
in Ores, Boundary Dist,. B.C	V	173
"Lime Dyke":		
Lardeau Dist., B.C.	VII	92
Limestone:		
Analyses	IV	153, 154
Charge of, in steel manufacture	X	381
Contact, deposits in	V	377
	X	177
Crushing	IV	208
Donald, paper by	IV	152–154
Galena, precipitated by	V	516
Graphite in	X	89
Iron ore deposits in, Bilbao, Spain	IV	198

	Vol.	Page
Limestone—Con.		
Karren structure, Alps	IV	201
for Manufacture of calcium carbide	IV	153
PARKS, notes on, by	VII	171
Pure, composition of	IV	152
Quality, wood pulp manufacture	IV	153
Silver-lead deposits in	V	514
Tremolite in	V	369
Use, Portland cement	IV	154
Alberta:		
Cascade coal basin	VIII	225 et seq.
British Columbia:		
Alberni Dist., V.I., B.C.	VI	197
Atlin Dist.	V	22
Boundary District:	V	365 et seq.
Emma mine, analysis	X	190
Franklin camp	X	171
Kettle River	V	514
Mother Lode mine	V	369
Phoenix camp	V	177
Kootenay East:		
Crowsnest Pass, thickness	IV	233
Elk River	IV	232,
	V	507
Fernie	IV	170
Purcell Mts.	V	507
Kootenay West:		
Lardeau Dist.	VII	89
Kootenay Lake	V	79
Rossland, Sophie Mt.	V	450
Texada Island	X	243 et seq.
Vancouver Island, notes by BEST	V	230
Labrador:		
Nastapoka Island, Hudson Bay	V	256
Mexico:		
Oaxaca	VIII	273
Nova Scotia:		
Boisdale Hills	VI	416, 425
Georges River	IV	312
Marble Mt., West Bay	IV	312
Production, 1899	III	189
1900	IV	312
Ontario:		
Blast furnace consumption, 1898-1900	IV	302
Eastern,	V	240
Frontenac county	VII	211
Grenville series, lead deposits in	VII	384
Haliburton Co., near Wilberforce	VII	178–179
Occurrences and uses, notes by MILLER	VII	390
Quebec:		
Blast furnace consumption, 1900	IV	305
Gaspé, petroleum-bearing	VI	128
Lake Mistassini	IX	19
Philipsburg, notes by DONALD	V	47 et seq.
St. Lawrence Valley	V	81

	Vol.	Page
Limestone—Con.:		
United States:		
Yerington, Nev., copper in	X	259
"Limited liability":		
Introduction of principle	IV	244
Limonite, *see also* Iron.		
Bilbao Dist., Spain	IV	200, 202, 203
Boundary Dist., B.C.	V	375
Eastern Pennsylvania	IV	203
Lardeau Dist., B.C.	VII	90
Magnetic permeability of	VI	11
Steep Rock Lake, Ont.	V	55
Lindgren, W.:		
Quoted on:		
Ascending waters	V	527
Metasomatic processes in fissure veins	IX	57
"Lingulae":		
Boisdale Hills, C.B.	VI	425
Linney, W.	X	20
Lipin, Prof. W. Von:		
Report by on molybdenum steel	VI	62
Lithia mica, *see* Lepidolite.		
Littland, *see under* Norway.		
Little Bobs mineral claim, Denmark Lake, Rainy River Dist., Ont.	VI	332
Little Bras d'Or Lake, C.B.	VI	411
Little Brompton Lake, Que.:		
Asbestos, chromite and copper at	VIII	271
Little Lake St. Francis	II	26
Little Ochiltree, Lothians, Scotland:		
Bitumen	VI	77
Little Sheep Creek, Rossland Dist., B.C.:		
Damming	V	475
Little Stobie mine, Sudbury Dist., Ont.	VII	64
Livet, *see under* France.		
Livingstone, East Kootenay, B.C., *see also* Crowsnest Pass.		
Coal seam	IV	233, 234
Lixiviation:		
Copper ore	V	197
Gold ores, Republic, Wash.	V	284
Ljunberg kiln:		
Method of charging	II	51
Lochaber, Antigonish County, N.S.	IV	311
Lochaber, Que.:		
Graphite at	X	90
Lochaber Plumbago Mining Co.	X	90
Locomotive engines:		
Petroleum burning	VIII	62
Lodge Pole Creek, East Kootenay, B.C.	IV	229
Lodyguine, Alexander:		
Electric smelting of titaniferous ores by	X	133
Log-washer:		
Description	VI	9
Logan, Sir William E.:		
Appointed Director of Geological Survey	IX	88
on Chert layers, Thunder Bay, Ont.	III	160
Elected Fellow of Royal Society	IX	90
First visit of, to Canada	IX	57

	Vol.	Page
Logan, Sir William E.—Con.:		
Honours conferred on	IX	93
Letters of to DE LA BECHE	IX	88, 89
Quoted on formation, Montreal Island	VIII	86
Tar Point, Gaspé, Que.	VI	77
Bruce Mines	X	150
Graphite	X	86
Resignation of Survey directorship	IX	94
	X	361
Work of, paper by BELL	X	342–370
Minor references	VII	455
	X	89, 168
Logs (TIMBER):		
Price, Rossland Dist., B.C.	VI	141
Londonderry, N.S.:		
Iron industry, 1898	II	59
Long Creek, WEST BRANCH OF SOURIS RIVER, SASK.:		
Coal at	X	237
Long Lake, SUDBURY DIST., ONT.:		
Serpentine	VIII	270
Long Tp., ALGOMA, ONT.:		
Iron in	VII	258
Longedal nickel mines, NORWAY	VII	406
Londonderry Iron & Mining Co.	IX	31
Long Island, CAPE BRETON:		
Formation	VI	411 et seq.
Long Island, HUDSON BAY:		
Anthraxolite	VII	253
Longwall system of coal mining:		
in Belgian mines	IV	128, 129
Frank, Alta., combined with pillar and stall	V	110
Lookout Mt., ROSSLAND DIST., B.C.:		
Granites	V	519
Loomis-Pettibone generator	V	178
Loon Creek Dist., CUSTER COUNTY, IDAHO:		
Lost Packer copper-gold lode	IX	54
Loon Lake iron mines, SAULT STE. MARIE, ONT.	VII	154
Loon Siding, THUNDER BAY, ONT.:		
Iron mining at	VII	154
Loring, Frank C.:		
Discussion by, on:		
The Status of the Mining Profession	X	338
Elected councillor, 1898	I	18
Lorne Creek, SKEENA DIV., B.C.:		
Gold	X	227
Lorne mineral claims, BRIDGE RIVER DISTRICT, B.C.	III	25, 28
***LOS REYES GOLD MINES, SOUTHERN MEXICO,** SMITH, A. H.	VIII	272–284
†***LOST PACKER COPPER-GOLD LODE, THE,** JENNINGS	IX	54–57
Loswe River, *see under* Russia.		
Lothians, *see under* Scotland.		
Louisburg, C.B.:		
Excursion of Institute to	IV	32

* See Summaries, page 105
† " " 111

	Vol.	Page
Louisa County, Virginia, U.S.A.:		
Pyrite	x	128
Louisiana, U.S.A.:		
Oilfields, evidences of vulcanism	vi	89
Loughboro Tp., Ont.:		
Mica mining in	vii	167
	vii	289
Love Tract nickel mine, Webster, N. Carolina	ix	305
Loveland Gold Dredging Co.	iv	297
Lovell and Christmas:		
Artesian well	viii	99
Low, Dr. A. P.:		
Appointed Director Geological Survey	x	5
Discussions by, on:		
Are there Diamonds in Ontario?	iii	196
A Canadian Department of Mines or Geological Survey	ix	112
Explorations of in Chibougamau, Que.	ix	218
on Iron ore deposits of Hudson Bay	iii	192
Lecture by, on:		
Mining possibilities of Arctic Canada	viii	22
Notes by on the Chibougamau Dist., Que.	ix	19, 222
Minor references	viii	9
	ix	13, 17
	x	106
Lowles, J.:		
On British investment in Canadian mines	iv	78–79
Luassavaara, *see under* Sweden.		
Lubricants:		
Application of	ii	33
Graphite	x	97
Oil:		
air compressors	v	159, 160
cost	iv	172
Lubrication:		
Of air cylinders	v	159–160
Lubricating oil, *see* Oil.		
Lucky Boy mineral claim, Trout Lake, Lardeau, B.C.	vii	101
Lucky Coon mineral claim, Seine River, Rainy River Dist., Ont.	vi	332
Lucky Jack mineral claim, Poplar Creek Dist., B.C.:		
Notes on by Brock	vii	101, 104
Lucky Jim zinc mine, Sandon, B.C.:		
Notes by Garde	vii	369
Lulea, *see under* Sweden.		
Lumbering:		
Allied with mining in Sweden	ii	42
British Columbia statistics 1901	vi	357, 363
1906	x	187
Waste in Ottawa mills	ii	50
Lundbohm:		
Quoted on:		
Iron ore deposits of Luassavaara, Sweden	ii	214
of Nordbotten Province, Sweden	ii	39
Lunenburg County, N.S.:		
Manganese	iii	189
Nickel ore	iii	226
Lyon County, Nevada, U.S.A.:		
Copper deposits in	x	257

	Vol.	Page
Lyndoch Tp., RENFREW C., ONT.		
Columbite	VII	254
Lynxhead Falls, SEINE RIVER, ONT.		
Formation at	VIII	184
Lytton, B.C.		
Gold dredging	V	89

M

M. & M. silver mine, WINDY ARM, Y.T.:		
Notes by CAIRNES	X	213
Vein on	IX	50
Workings on	IX	52
Mabou mine, SLOCAN DIST., B.C.:		
Veins	V	12
McAllister, J. E.:		
Supt. Greenwood smelter	IX	352, 357
McAllister nickel mine, SUDBURY, ONT.	VII	496, 497
McAllister and Medcalf	VII	496
McAree, John:		
Death of	VII	3
Discussion by, on:		
The National Importance of Mining	V	137–138
McArthur, James:		
Elected Councillor, C.M.I., 1898	I	18
McArthur, Peter	X	356
McArthur nickel mines, SUDBURY DIST., ONT.:		
Ore deposit	V	529
McCALLUM, A. C.:		
****Metallurgical Machinery***	II	28
McCarren Creek, BOUNDARY DIST., B.C.:	V	366
McCaw:		
Prospecting by at Little Brompton Lake, Que.	VIII	271
McClarin, G.	IX	285
McConnell, R.:		
Nickel discoveries of	VII	496–7
McCONNELL, R. G.:		
on Coal in the Yukon	III	212
Estimate of gold in Klondike	III	213
On the origin of ancient river gravels, Klondike, Yukon	III	209, 210
Papers by:		
†***Note on Windy Arm Silver Bearing Veins***	IX	49–53
‡***The Old Valley Gravels of the Klondike***	III	124–127
Report by on Rossland Dist., ref. to	VII	48, 59
Survey of Salmon River Dist., B.C., 1897	II	4
Minor reference	II	86
McConnell graphite mine, PERTH, ONT.	VII	161
McConnell nickel mine, SUDBURY, ONT., *see also* Copper Cliff mine	VII	497

* See Summaries, page 5
† " " 110
‡ See Summaries, page 21

	Vol.	Page
McCormack, Wm.	IX	332
MacDonald, Baroness	VII	496
MacDONALD, BERNARD:		
Appointed manager LeRoi mine	V	312
Discussions by, on:		
Description of the Sultana Quartz Lode and the Sinking of the Burley Shaft on Bald Indian Bay	II	241
The Gold Measures of Nova Scotia and Deep Mining	II	246
The Influence of Government on Mining	VI	364, 369
Papers by:		
**Hoisting and Haulage in Mining Operations. A Description of the Plant on the LeRoi Mine, Rossland, B.C.*	V	309–342
†Improved Method of Introducing Feedwater to the Stamp-mill Mortar	II	54
‡Supplement to	II	102
¶Mine Signalling by Compressed Air	VI	161–168
‖Mine Timbering by the Square Set System Rossland, B.C.	VI	129–145
°Mining Possibilities of the Canadian Rockies	VI	337–354
Min. ref.	VI	439, 440
	VII	433
MacDonald, Sir William:		
Benefices to McGill University	V	4, 6
McDonald Creek, TIMAGAMI DIST., ONT.:		
Outcrop of jaspilyte on	IV	278
McDougal Creek, FISH RIVER, LARDEAU, B.C.	VII	93
McDougall furnace:		
Notes on roasting with, by SORENSEN	VI	306–316
McDougall, Geo.	VII	10
McDougall, John & Co., *see also* Grantham Iron works.		
Pig iron production, bounty paid on, 1900	IV	313
McEVOY, JAMES:		
Discussion by, on:		
The National Importance of Mining	V	149–150
Elected as Councillor 1904	VII	22
1906	IX	27
1907	X	17
Paper by:		
***Notes on the Special Features of Coal Mining in the Crowsnest, B.C.*	VII	500–504
Views on a Canadian Dept. of Mines	V	594
MacFarlane, Franklin	X	170
Macfarlane, Thomas:		
Quoted on the geology of Norway	VII	401, 406
McGill University, MONTREAL:		
Metallurgical laboratories, description by STANSFIELD	IX	183
Mining course	V	4 et seq
	IX	150
Laboratories, plan of	IX	179
Ore dressing, work of	IX	153
McGown mine, PARRY SOUND, DIST., ONT.	VII	121, 142
CARTER, notes by, on	VII	146

* See Summaries, page 51
† " " 6
‡ " " 9
¶ See Summaries, page 63
‖ " " 62
° " " 70
** See Summaries, page 91

	Vol.	Page
MacGregor, James:		
Death	III	179
Machine shop:		
Brayton Domain colliery, England	IX	409
Centre Star mine, ROSSLAND, B.C.	V	473
Coal Creek colliery, B.C.	IV	172–3
LeRoi mine, Rossland	V	338, 406
McIntyre & Grainger	VIII	174
McKay Gulch, KLONDIKE, Y.T.	III	124
McKee Creek, ATLIN DIST., B.C.	III	98
Gold production, 1900-1901	V	32
GWILLIM, notes by	V	32
McKeller Bros.	IX	285
McKellar mine, NEAR SABAWE LAKE, ATIKOKAN, ONT.:		
Development of	IX	299
MacKenzie, Sir Alexander	X	218
McKenzie Bay, CHIBOUGAMAU, QUE.:		
Asbestos at	X	105
Serpentine at	IX	19
McKenzie, Peter:		
Explorations by, Chibougamau, Que	VIII	363,
	IX	17
Mineral discoveries of in Chibougamau, Que.	IX	218
MacKenzie, Wm.	VII	255
McKim Tp., SUDBURY DIST., ONT.:		
Geological mapping in	IX	223
Nickel in	VII	496, 498
McKinley claim, FRANKLIN CAMP, B.C.:		
Description of	X	173
McKinnon & Shafer	VIII	174
McLAREN, G. R.:		
****Underground Mining Methods at the Quincy Copper Mine, Michigan***	X	399–417
McLeish, John:		
Report by, on:		
Canadian mineral production 1906	X	12
McLennan, Dr.:		
Discussion by, on:		
A Mineral containing Radium in Quebec	VII	251, 252 253, 255
McLennan, J. S.:		
On coal mining in Cape Breton	IV	21–22
McNeill, H. W. & Co.:		
Coal mines, Canmore and Anthracite, Alta	V	109, 110
production 1900	IV	298
Minor references	VI	373
McPhee coal mine, TABER, ALTA.:		
Coal, quality of	X	234
Macrospores:		
LAKE HURON, ONT.	II	187
Madawaska River, OTTAWA RIVER, ONT.:		
Corundum on	VII	418
Power from	VII	161
Madison, Wisconsin, U.S.A.:		
Diamonds discovered at	III	152

* See Summaries, page 147

	Vol.	Page
Madoc, Madoc Tp., Hastings Co., Ont.:		
Iron ores of		
Talc-deposit at	v	245
mining near	vii	167
Uranite	vii	254
Madoc Tp., Hastings Co., Ont.:		
Gold discovery in	vii	117
Pyrite	v	242
mining	vii	157
Madras, *see under* India.		
Maggie May mineral claim, Poplar Creek Dist., B.C.	vii	104
Magmas:		
Acidic, notes on, by Kemp	x	255
Boundary Dist., B.C.	v	371
Carbon in interior fluid	vi	75
Magmatic differentiation:		
Atikokan, Ont., iron	v	56
Barlow, notes by	vii	63
Sudbury Dist., Ont.	v	538
Varying degrees of superfusion in, paper by Lane	ix	210–217
***MAGMATIC WATERS,** Hixon	x	301–308
Discussion by:		
Coleman, Miller, Kemp, Bell, Haultain	x	309–320
Magnalium:		
Composition	vi	39
Magnesia:		
Determination of	x	451
in Limestone for wood-pulp manufacture	iv	153
Magnesite:		
Atlin Dist., B.C.	v	21
Chibougamau Dist., Que.	viii	365
For furnace lining	ix	131
	x	381
Magnesium:		
Production and uses	vi	39
Magnetic concentration, *see also* Concentration.		
Chromite	v	7
Costs	vii	283
Iron:		
experiment by Hille	v	58
Grondal process, paper by Bennie	x	261
notes by Cirkel	x	111
Wells	vi	6–20
Molybdenite	vi	53
Nickel	iv	188
Sudbury Dist.	x	277
Slocan Dist., B.C.	v	14
Zinc	v	8
Leadville, Col.	vii	376
paper by Snyder	vii	270–277
Payne mine, Slocan	vii	372
†***MAGNETIC CONCENTRATION OF IRON ORES BY THE GRONDAL PROCESS.*** Bennie	x	261–273
Magnetic concentrators:		
Types	vi	12

* See Summaries, page 145
† " " 143

	Vol.	Page
Magnetic Cone, CHIBOUGAMAU DIST., QUE.:		
Iron on	VIII	365
	IX	18
Magnetic iron-sand, *see also* Iron sands.		
Gulf of St. Lawrence	II	62
Wreck Bay, Vancouver Island, gold in	V	231
Magnetic measurements:		
Of iron deposits, address by HAANEL	VI	477
Magnetic permeability:		
Iron ores	VI	11
***MAGNETIC SEPARATION,** SNYDER	VII	270–277
Discussion by MILLER, CRAIG, B. A. C., OBALSKI, PORTER, BARLOW, GIBSON, BAKER, SNYDER	VII	277–283
Magnetic separators:		
Efficiency compared with Wilfley table	VI	56
Molybdenite	VI	53
SNYDER	VII	278
Types of	VII	270
WETHERILL	V	9
	VII	280
Magnetic surveying:		
BROCK, notes by	V	377
Timagami iron range, Ont	VII	266
Magnetite, *see also* Iron.		
Attraction of, for oil	VII	187
Concentration	VI	6
by Grondal process	X	263
Constituents of	X	275
Crushing	IV	208, 210
Electric smelting of	VIII	136, 138, 156
Magnetic measurements of	VI	477
permeability of	VI	11
Smelting of	X	111

British Columbia:		
Boundary Dist., B.C.	V	368
origin	V	371
Emma mine	X	188, 190
Kamloops Lake, Cherry Bluff	V	371
Mother Lode mine	V	515
Phoenix, Knob Hill-Ironsides mine, gold values in	V	373
Texada Island	X	245
Vancouver Island	V	229
	VI	190, 199,
	IX	42
New Brunswick:		
St. Stephen nickel deposits	IX	239
Ontario:		
Algoma Dist.	IV	281
Atikokan Dist.	IX	291
Lake Superior, analyses	II	50

* See Summaries, page 82

	Vol.	Page
Magnetite—Con.:		
Ontario—Con.:		
Notes by MILLER	IV	265, 7–8
Rainy River Div	V	51
Thunder Bay Dist	IV	281
Quebec:		
Hull Tps	IV	305
"Magnetitic type of ore deposit":		
Boundary Dist., B.C., analyses	V	368, 371, 516
Franklin Camp	X	172
Magneto-electric machine:		
Invention of	III	133
Magog River, QUE.:		
Placer gold in	VIII	264
Magpie River, ALGOMA DIST., ONT.:		
Magnetite	IV	281
Maiden Island, ONT.:		
Gold quartz	II	239
Maidstone Tp., ONT.:		
Natural gas	III	74
Petroleum	III	74
Mamainse, MICHIPICOTEN ISLAND, ONT.:		
Columbite	VII	254
Copper ores at	VII	147
Maine, U.S.A.:		
Mica	VII	287
Maisonneuve, QUE.:		
Artesian well at	VIII	92
Maisonneuve mica mine, BERTHIER CO., QUE.:		
Samarskite at	IX	72
Malachite:		
Boundary Dist., B.C., King Solomon mine	V	375
Conrad, Y.T.	X	211
Yerington, Nev.	X	259
Malachite Point, CHIBOUGAMAU LAKE, QUE.:		
Nickeliferous pyrrhotite at	IX	221
Malzac ammonia process	VIII	358
Mamie copper claim, PRINCE OF WALES ISLAND, ALASKA	X	202
Mammoth:		
"Mining" for remains in Siberia	VI	46
Mammoth Bluff, BRITANNIA MINES, B.C.	IX	44
Manganese:		
Determination of	X	449
Nastapoka Islands, Hudson Bay	V	257–8
New Brunswick	IV	309
Production: 1901	V	572
1902	VI	454
MILLER, notes by on	VI	40
Nova Scotia 1899	III	189
Separation of	VII	276
Tests for, in pig iron	VI	292
Use, dredge buckets	V	92
Wire rope, manufacture	V	38
Manganiferous iron:		
Hydrocarbons from	VI	124, 126
Manitoba:		
Coal bearing horizon in	VIII	223
production, 1902	VI	454
and coalfields of, report on by DOWLING	X	229–241

	Vol.	Page
Manitoba—Con.		
Mineral industry 1900	IV	299
Mining in, notes by BELL	V	578
Manitoba Union Mining Co.:		
Gypsum	IV	299,
	V	578
Manitou Div., ONT.:		
Rocks of	VIII	185
Manitounuk series (LOWER CAMBRIAN) :		
Nastapoka Islands, Hudson Bay	V	256
Mansfield copper mines, *see under* Germany.		
* ***ON THE MANUFACTURE OF SULPHURIC ACID AT SYDNEY, C.B.,*** MEISSNER	VI	390–407
Manxman gold mine, MICHIPICOTEN, ONT.	VII	122
Map(s):		
Canadian, notes by COSTE	VI	468
Conventional signs for mineral	VIII	327
Geological, value of, notes by ADAMS	V	586
Government issues of, notes by MCAREE	V	138
Logan's method of plotting	X	366
Value of, notes by WHITE	VI	317
Alberta:		
Alberta-Saskatchewan-Manitoba coal areas	X	241
Cascade and Bow Valleys	VIII	222
America, north:		
Western portion, illustrating precious mineral production	VI	344
British Columbia:		
Atlin Dist., Pine-Spruce valley	V	25
Bridge River District	III	22
Crowsnest Pass District	IV	158, 230
Franklin Camp	X	171, 176
Goat River mining division	V	77
Kitchener iron range	V	78
Lardeau & Trout Lake mineral belts	VII	100
Nelson, Athabasca mine	V	17, 18, 19
Rossland mining district	V	446,
	VII	48
Rossland District, Centre Star mine	VIII	328
geology	V	504
Skeena River	X	224 (opp.)
Texada Island	X	246
Cape Breton:		
Boisdale Hills, C.B.	VI	424
Port Morien	IV	131
Hudson Bay:		
Nastapoka Islands	V	256
Manitoba:		
Coal areas	X	241
Newfoundland:		
Wabana iron mine, Bell Island	III	132
Ontario:		
Atikokan Dist.	IX	292
Barrie Tp., Frontenac Co.	VII	236

* See Summaries, page 72

Map(s)—Con.	Vol.	Page
Ontario—Con.:		
Eastern, gold belt	V	239
Mica occurrences	VII	296
Northern, iron resources	IV	280
Province	VII	115
Western, iron ore deposits	V	56
Quebec:		
Eastern Tps.,	VII	397,
	VIII	261
Mica occurrences	VII	296
Iron sands, St. Lawrence river	IV	96
Saskatchewan:		
Coal areas	X	241
Spain:		
Vizcaya & Santander provinces	IV	196
United States:		
Methods of making	IX	79
Hawaiian Islands	VII	74
Webster, N. Carolina, nickel bearing area	IX	316 (opp.)
Maple Bay, PORTLAND CANAL, B.C.:		
Copper occurrence at	X	207
Maple Bay, VANCOUVER ISLAND, B.C.:		
Formation	VI	195
Maple Leaf claim, FRANKLIN CAMP, B.C.	X	174
Maple Leaf iron claim, KITCHENER, B.C.	V	77
Maple wood:		
For charcoal	II	46, 47
Marble:		
Boisdale Hills, C.B.	VI	432
Franklin Camp, B.C.	X	178
Ontario resources, notes by MILLER	VII	389
Philipsburg, Que.	V	47
Texada Island, B.C.	X	243
Marble Bay, TEXADA ISLAND, B.C.:		
Copper at	VIII	173
Geology and ore deposit of, paper by LEROY	X	242–256
Mine depth of	X	197
Workings	IX	40
***MARBLE BAY COPPER DEPOSIT,** LEROY	X	242–256
Marble Lake, BARRIE TP., FRONTENAC CO., ONT.	VII	235
Marble Mt., WEST BAY, N.S.:		
Limestone	IV	312
Marcasite:		
Boundary Dist., B.C.	V	368
Mt. Sicker Dist., B.C.	IX	47
West Kootenay, B.C.	II	76
March Tp., CARLETON CO., ONT.:		
Rocks in	VII	289
Marchese electrolytic refining process:		
Diagram	V	210
Description	V	194
Marcou, Jules	X	359
Marggraf:		
Platinum refined by	VIII	193

* See Summaries, page 141

	Vol.	Page
Mariposa gold mine, MICHIPICOTEN, ONT.	VII	122
Mark Creek, KIMBERLEY, B.C.:		
Silver-lead ore	V	512
Markets:		
Coal:		
British Columbia	VII	424
Western Canada	IV	170
Copper matte, Northport, Wash.	V	341
Marmora, HASTINGS CO., ONT.:		
Formation at	VII	216, 218
Marmora Tp., HASTINGS CO., ONT.:		
Gold mines	IV	303
Marquette:		
Exploration by, of Lake Michigan	III	32
Marquette iron range, MICH., U.S.A.:		
Freight rates on iron	IV	283
Ore deposition	IV	274
Regent mines, paper by ATKINSON	VII	319–334
WILLMOTT, note by on	VII	259
Marquis & Gilbert	VII	103
Marsaut, M.:		
Experiments with Wolf safety lamps	VI	207
Lamp, test	V	383
Marsh coal mine, ANTHRACITE, ALTA.	X	232
Marsh gas, *see also* Gases, Hydrocarbons.		
in Anthracite coal mines	VI	203
Calorific power of	IV	138
Marten Creek, CROWSNEST PASS, B.C.:		
Coal, hardness	X	232
seams	X	230, 232
Martin, P. & E.	X	374
Martite, *see also* iron.		
Mattawin River, Que.	V	52
Maryland, U.S.A.:		
Coal at plain, formation	VIII	81
MASON, F. H.:		
***Coal, Gas & Coke as Domestic Fuel**	IV	135–142
Mason Valley Mts., LYON COUNTY, NEV., U.S.A.	X	257
Massachusetts Institute of Technology:		
Chemical laboratories at	V	4
Massanoga Lake, EFFINGHAM TP., ONT.:		
Muscovite deposit near	VII	289
Massey Dist., ONT.:		
Geological formation in	VII	183
Massey Station copper mine, MASSEY STATION, ALGOMA, ONT.:		
CARTER, notes by on	VII	145
MILLER, notes by on	VII	383
Masterman, A. S. & W. S.	VIII	90
Matawatchan Tp., RENFREW CO., ONT.:		
Molybdenite	VI	49
Matawin Range, THUNDER BAY DIST., ONT.:		
Iron ore	IV	282,
	V	51,
	VII	154, 257

* See Summaries, page 28

	Vol.	Page
Matte:		
Anaconda Copper Co.	VIII	350, 352
Cobalt	VII	407
treatment of	X	75
Copper, Boundary Dist., B.C.	V	174
Nickel-copper:		
analyses	V	534, 548
composition	V	236
	VII	498
Copper Cliff, Ont.	V	548
distribution of values in	VII	67
palladium in	VIII	211, 212
refining of:		
abroad	IV	231
electrolytic	V	192, 197, 394
Rossland, B.C.	II	118
cost of producing	V	314
Sampling	II	118
Separator, paper by HEDLEY	IX	58–63
Mawdach Gold Dredging Co.	V	89
Meaderville, MONTANA, U.S.A.	X	253
Medicine Hat coalfield, ALTA.:		
Coal, analysis	VIII	237
available supply per square mile	V	112
character of	V	106
quality of	X	234
seams	X	233
Medina formation:		
Depth of	II	208
Natural gas in	III	69, 80
New York State, U.S.A.	III	82
Oil and gas in	VI	112
Ontario:		
Brant County	VII	175
Petroleum	III	78
Welland County	III	82
Western	II	190
Meech furnace patent	VI	306
Meeting Creek, PEACE RIVER, ALTA.:		
Coal on	X	236
Megantic Co., QUE.:		
Chrome mining in	II	25
Meggen, *see under* Germany.		
MEISSNER, C. A.:		
Discussion by on:		
The National Importance of Mining	V	125–133, 153
Elected Councillor of Institute	VIII	34
Papers by:		
**On the Manufacture of Sulphuric Acid at Sydney, C.B.*	VI	390–407
†*Prospecting for Iron Ore in Newfoundland and Cape Breton*	II	66–71

* See Summaries, page 72
† " " 7

	Vol.	Page
Melaconite:		
King Solomon mine, Boundary Dist., B. C.	v	375
Melbourne, QUE.:		
Logan's work near	x	359
Placer gold at	viii	262
Melting furnace:		
BRENT, paper by	v	288–295
Melting point:		
Nickel	v	550
Membership of Institute, *see under* Canadian Mining Institute.		
Mendelejeff:		
Quoted on:		
Composition of earth's interior	iii	196, 207
Carbons and the hydrocarbons	vi	123
Carbon forms in magma	vi	75
Menominee Dist., WISCONSIN, U.S.A:		
Formation in	ix	127
Iron range, freight rates	iv	283
Mercury, *see also* Cinnabar, Quicksilver, and Amalgamation.		
Consumption, Ymir Mill, B.C.	iii	10
Feeding to mortars, Deloro, Ont.	iv	115
Ontario occurrence of	vii	380
Quantity of, in amalgamation of gold ores	ii	206
in Stamp mill practice	ii	234
Mercury iodide	ii	13
MERRITT, W. HAMILTON:		
Elected Councillor, C.M.I., 1898	i	18
Paper by:		
***Occurrence of Free Milling Gold Veins in British Columbia**	ii	143
Mesabi iron range, MINN., U.S.A.:		
Development of	iv	25, 274
Ore deposits, notes by LEITH	vi	462
VAN HISE, notes by on	vi	248
Mesh:		
Standard of in metallurgical practice	ii	4, 206
Metallurgical calculations:		
Use of Graphic Formulae for, paper by BROWNE	x	281
Metallurgical exhibition:		
Proposal to hold, in Montreal	ii	253
Metallurgical laboratory:		
McGill University	ix	183
†***Metallurgical Machinery,*** MCCALLUM	ii	28
‡***Metallurgical Standards,*** SNYDER	ii	3–12
Discussion on, HARDMAN	ii	207
Metallurgical works:		
Government operated, New South Wales	v	136
Metallurgy, *see also* Concentration, Cyanide Process, Metals, Smelting, &c.		
Bessemer process, first application of, in Sweden	ii	40
Bromo-cyanide process	iv	143 et seq.
Copper:		
casting in slabs	ii	115
roasting, Highland Boy, Utah	vi	306 et seq.
Iron:		
in Sweden	ii	38, 218

* See Summaries, page 12
† " " 5
‡ See Summaries, page 2.

	Vol.	Page
Metallurgy—Con.:		
Laboratory teaching in	v	4
Machinery, standardization of	ii	28
Nickel:		
Orford process	iii	225
Sudbury Dist.	v	544 et seq.
Teaching of, paper by STANSFIELD	ix	180–191
Weights, standardization of, in practice	ii	4
Metals:		
Base, not prerogative of Crown	iii	113
Electrolytic production, paper by KOEHLER	v	189–212
Melting, experiments at McGill University	v	7
New, discovery of, in XIXth century	vi	35
Metamorphism:		
Anthracite, Alta., effect of on coal	v	110
Goldfield, Nevada	viii	43
Kimberley, B.C.	v	513
Lethbridge coalfield, Alta.	v	106
Metasomatic action:		
Butte, Montana	v	297
Copper Mt., Similkameen Dist., B.C.	v	499
Kootenay West, B.C.	ii	80
Loon Creek Dist., Idaho	ix	57
Sudbury Dist., Ont.	v	538
Meteor Lake, NIPISSING DIST., ONT.:		
Jaspilyte	iv	280
Meteoric waters	v	53
Meteorites:		
Analysis	vi	170
Carbon in	iii	207
Composition	vi	125
Methane, *see* Gases.		
**A METHOD OF COST ACCOUNTING WITH SPECIAL REFERENCE TO MINES.* HARDMAN	iii	37–67
†*A METHOD OF MINING LOW GRADE ORES IN THE BOUNDARY DISTRICT.* KEFFER	v	213–217
‡*METHODS OF OBTAINING WATER SUPPLY FOR SUGAR PLANTATIONS IN THE HAWAIIAN ISLANDS.* WILLIAMS	vii	70–81
Methuen Tp., PETERBOROUGH CO., ONT.:		
Mica	vii	289, 304
notes on by MORRISON	vii	304
Mexico:		
Cordilleran system, mineral wealth of	vii	468
Gold production, 1801–1900	vi	25
notes on by MACDONALD	vi	339
Graphite statistics	x	101, 102
Mining in:		
capital invested in	vii	478
contract labour in mines	viii	278
early, notes by SMITH	viii	274
law	v	151
	vii	478
Silver:		
mining, notes by MILLER	vi	34
production, notes on by MACDONALD	vi	339

* See Summaries, page 17
† " " 46
‡ See Summaries, page 75

	Vol.	Page
MEYER, LEOPOLD:		
Notes on the Driving of Simplon Tunnel, Swiss Alps	II	137 et seq.
Meyer's Cave, BARRIE TP., ONT.	VII	211
Mica:		
Application and uses, notes by MILLER	VI	44
Arctic Canada	VIII	22
Canadian:		
markets for	IV	306
quality of, report on by PROF. DUNSTAN	IV	307
statistics, 1901	V	571
1902	VI	454
India	IV	308
Occurrences, Production and Uses, paper by CORKILL	VII	284–303
Trade	IV	306
United States production, 1899	IV	308
Ontario:		
Industry and resources	V	244, 245
Mines of, notes by CARTER	VII	161
Occurrences:		
notes by Miller	V	243
	VII	378
in pegmatite	VII	254
Statistics:		
1900	IV	304
1902	VI	464, 465 466
1903	VII	426, 430
1893–1903	VII	392
Quebec:		
Industry:		
1898	II	64
1900	IV	305
Statistics:		
1898	II	65
1899	III	187
1900	V	350
Mica Boiler Covering Co., TORONTO:		
Exhibit, Buffalo Exposition	V	252
Mica flour :		
Uses	V	251
	VII	303
Mica scrap:		
Uses	V	245, 251
Mica-schist:		
Attraction of, for oil	VII	187
Fairview Camp, B.C.	II	147
New Caledonia	VI	169
Micanite (OR MICA BOARD)	VII	164, 302
GIBSON, notes by	VII	426
Micaville, N. BURGESS TP., LANARK CO., ONT.:		
Mica mining near	VII	163

* See Summaries, page 11

	Vol.	Page
Michel, August :		
Quoted on Beauce goldfields	VIII	259
Michel, CROWNSEST PASS, B.C.:		
Coal, analysis	VII	503, 504
fuel ratio of	X	230, 232
measures	IV	232
seams	VII	502 et seq.
Michigamme iron mine, MICH., U.S.A.:		
Magnetic concentration	IV	17
Michigan, U.S.A.	III	153
Diamonds in	IX	124
Iron mining	VII	319–334
Limestone, notes by LANE	V	47
Michipicoten Harbour, ALGOMA DIST., ONT.:		
Jaspilyte	IV	279, 280
Michipicoten Island, ONT.:		
Copper-bearing rocks of	VII	147
Copper, native	X	400
Genthite from	IX	306
analysis	IX	307
Michipicoten mining division, ALGOMA, ONT.:		
Gold mines	VII	122
Iron deposits	III	192
formation	VII	257, 260
mining	III	121
notes by CARTER	VII	154
Mining regulations in	VII	462
Nickel in	III	224
Pyrite deposits	VII	157
	X	121
notes by VAN HISE	X	125
MICKLE, G. R.:		
Discussions by, on:		
The Attraction of Minerals for Oil	VII	189, 191
The Dry Ores of the Slocan, B.C.	VII	207
A Mineral Containing Radium in the Province of Quebec	VII	253
The Ore Deposits of Rossland District, B.C.	VII	66
Solution of Gold in Potassium Cyanide	VII	196, 197, 198
Some Mining Camps in the Lardeau Dist., B.C.	VII	112
The Volcanic Origin of Natural Gas and Petroleum	VI	123–126, 474
Papers by, on:		
**Iron-Bearing Rocks of the Nastapokan Islands*	V	256–264
†*Value of Undeveloped Mining Claims*	VIII	111–117
Min. ref.	VI	478, 484
	VII	243, 318, 334
Micmac gold mine, LEIPSIGATE DIST., N.S.:		
Gold recovery at	VII	318
Microcline, *see* Feldspar.		
Micrometer:		
Use of, in determining size of mesh of screens	II	6

* See Summaries, page 48
† " " 96

	Vol.	Page
Microphotographs:		
Ash rock, Rossland Dist., B.C.	v	449
Augite, Rossland Dist., B.C.	v	448
Augite-porphyrite, Rossland, B.C.	v	450, 451
Wall rock, Iron Horse mine, Rossland, B.C.	v	452
**THE MICROSTRUCTURE OF NICKELIFEROUS PYRRHOTITES*, CAMPBELL & KNIGHT	x	274–280
Mida, B.C.:		
Coal analysis	vii	424
Midland blast furnace, MIDLAND BAY, ONT.:		
Description of	x	442
Min. ref. to	iv	267, 302
	vii	155
Mikado gold mine, RAINY RIVER DIST., ONT.	vi	332
Notes by CARTER	vii	132, 134
Milford, OHIO:		
Diamonds discovered at	iii	152–153
Milk River, ALTA.:		
Coal on	x	234
Mill, Dr. H. R.	vi	317
Mill Creek, OLDMAN RIVER, ALTA.:		
Coal on	x	234
Mill scale	viii	49
Miller Tp., FRONTENAC CO., ONT.:		
Molybdenite	vi	50
MILLER, DR. WILLET G.:		
Corundum in Ontario, address by	iii	200–201
discovered by	vii	413, 414
Discussions by, on:		
The British Columbia Lead Problem	vii	374, 375, 376
A Canadian Department of Mines or Geological Survey	ix	112
The Exploration of Ontario's Iron Ranges	vii	265, 267
The Iron Ore Deposits of the Mesabi District	vi	462
Magnetic Separation	vii	278
A Mineral Containing Radium in Quebec	vii	251, 252, 253, 255
Mining and Smelting in Boundary District	vi	45
The Nickel Deposits of New Caledonia	vi	484
The Occurrences, Production and Uses of Mica	vii	303, 304, 307
The Ore Deposits of the Cobalt District, Ont.	x	57
Some Mining Camps in the Lardeau Dist., B.C.	vii	111, 113
The Study of Stratigraphy	vii	174–176
Elected Councillor, 1906	ix	27
Vice-President, 1907	x	17
Notes by, on:		
Cobalt District	x	15
discovery of silver	viii	36
Papers by:		
†*Eastern Ontario, A Region of Varied Mining Industries*	v	233–255
‡*The Iron Ore Fields of Ontario*	iv	265–283
¶*Notes on the History of the Mineral Industry in the Nineteenth Century*	vi	21–46
‖*Undeveloped Mineral Resources of Ontario*	vii	377–392

* See Summaries, page 144
† " " 48
‡ " " 36
¶ See Summaries, page 59
‖ " " 85

	Vol.	Page
MILLER, DR. WILLET G.—Cod.		
Quoted on:		
Corundum in Ontario	VII	412
Geology of Ottawa Co., Que.	VII	290
Report of, as Convenor of By-Law Committee, 1905.	VIII	23
Reports by, on:		
Nickel production	IX	14
Savant Lake gold gravels	VII	118
Timagami iron, referred to	X	127
Story by, on "Oil, Hell or China"	VI	477
Views on:		
Export duty on nickel matte	III	241
Iron ore deposits of north-east Ontario	III	193
Min. ref.	VI	477, 486
	VII	2, 13, 16, 17, 210, 215, 242, 243, 244, 257, 268, 305, 432
	VIII	9
	IX	23
	X	50, 68, 125, 310
Millerite:		
Orford Co., Quebec	III	224
Sudbury Dist., Ont.	V	534
Milling, *see* Stamp Milling.		
MILLS, S. DILLON:		
Discussions by, on:		
The Attraction of Minerals for Residuum Oil	VII	189
The Bed-Rock of the Gilbert River Gold Fields	VIII	265
Electric Smelting	VIII	156
A Mineral Containing Radium in Quebec	VII	254, 255
Solution of Gold in Potassium Cyanide	VII	196
The Status of the Mining Profession	X	332
Paper by:		
****Some Recent Rock Movements in the Laurentian and Huronian areas***	VII	177–184
Min. ref.	VII	10, 243, 244
	X	169
Millstone grit:		
Boisdale Hills, C.B.	VI	417, 429
Pictou coalfield:		
Stellarton formation	V	358
Westville formation	V	361
Milton Pressed Brick & Terra Cotta Co.:		
Exhibit by, Buffalo Exposition	V	254
Milwaukee, MINN., U.S.A.:		
Diamonds found near	IX	127
Mimico, ETOBICOKE TP., YORK CO., ONT.:		
Natural gas at	III	68
Minas Geraes, BRAZIL:		
Platinum occurrence	VIII	198
Mine accidents, *see also* Accidents.		
Royal Commission report respecting	V	390

* See Summaries, page 78

	Vol.	Page
Mine accounting, *see also* Cost Accounting, Costs, &c.		
Blacksmith shop charges	IV	173
HARDMAN, paper by, on methods	III	37 et seq.
Mine bulkheads, *see* Bulkheads.		
Mine-car:		
Dimensions, Rossland District	V	461
In iron mines, description of	VII	348
Mine Centre, SHOAL LAKE, SEINE RIVER, ONT.:		
Gold mining near	VII	136
Granite at	VIII	184
Mine costs, *see also* Costs.		
Boundary Dist., B.C.	V	176
Classification	III	51
LeRoi mine, Rossland	V	314
Slocan Dist., B.C.	V	13
Mine development:		
Suggested methods for Nova Scotia gold areas	II	247
***MINE DEVELOPMENT METHODS,** FORREST	VI	1–5
Mine drainage:		
Brayton Domain colliery, England	IX	404
Mine fans, *see* Fans.		
Mine illuminants:		
Acetylene	II	227–229
		231
	IX	404
Benzolene, in safety lamps	VI	207
Electricity, Centre Star, Rossland, B.C.	V	467
Mine inspection:		
Appointments, SJOSTEDT's views on	V	141
MCAREE, notes by, on	V	137–8
Quebec	V	154
Mine labour, *see* Labour.		
Mine lighting, *see also* Illuminants, Safety Lamps, etc.		
Coal Creek colliery, B.C.	IV	166
Grand Calumet silver-lead mine	II	228
Susquehanna Coal Co., Pa.	IX	385
Mine management:		
Economics of	III	11–20
Expenses of, in mine accounting	III	47
Gold dredging, British Columbia	V	88
Mine mapping:		
Conventional signs in	VIII	327
Mine models:		
Notes by CARMICHAEL	VI	440
Mine Owner's Association, of B.C.	V	319
Mine plans:		
Necessary data for	IV	99
Use of pocket compass in making	IV	101–106
Mine pumps, *see* Pumps.		
Mine signals, *see* Signals.		
†***MINE SIGNALLING BY COMPRESSED AIR,** MACDONALD & THOMPSON	VI	161–168
Mine supplies:		
Accounting of	III	42
Mine surveying:		
Coal mines	IX	204
Simple instrument for, paper by ROBBINS	IV	99–106

* See Summaries, page 58
† " " 63

	Vol.	Page
***MINE SURVEYING AS CARRIED ON AT CENTRE STAR MINE, ROSSLAND, B.C.,** COLE, L. H.	VIII	317–335
Discussion by COATES, GARDE	VIII	335
Mine taxation:		
Action of Institute regarding	VII	32
CAMPBELL-JOHNSTON, views on	V	135
Ontario:		
proposed export duty on nickel	III	226
report and resolution of Institute Committee on	X	13–14
right to levy, in	III	116
Principle of export duty	III	226
Mine timbering, *see also* Timbering.		
†***MINE TIMBERING IN THE OLD IRONSIDES AND KNOB HILL MINES,** DEPENCIER	V	424–446
‡***MINE TIMBERING BY THE SQUARE SET SYSTEM AT ROSSLAND, B.C.,** MACDONALD	VI	129–141
Discussion by WOAKES, MACDONALD	VI	141–145
Mineral(s):		
British North America Act respecting	V	113
Collection of, supplied to schools	IX	100
Production per capita, U. S. and Can.	VI	67
Radio-activity of	VII	252
Treatment of, by oil process	VII	185–191
¶***ON A MINERAL CONTAINING "RADIUM", IN THE PROVINCE OF QUEBEC,** OBALSKI	VII	245–251
Discussion by:		
OBALSKI, MILLER, MCLENNAN, MICKLE, MILLS, FRALECK	VII	251–256
Mineral belt:		
In Ontario, extent of	III	150
Mineral claims:		
British Columbia:		
Atlin district, size	III	205
assessment work in	III	142, 143
Crown-granted, 1901	VI	356
proportion of worthless	III	199
in Canada, regulation respecting acquisition of, paper by COSTE	VII	451 et seq.
Ontario:		
compensation to owner of surface rights	III	115, 116
condition of title to, in	III	111
size of, in	III	112
statistics of, 1897-1902	VII	460
taxation of, notes by COSTE	VII	459
Value of undeveloped, paper by MICKLE	VIII	111–127
Mineral exhibit:		
Pan-American Exposition, Buffalo	V	252
Mineral Hill, ALBERNI DIST., V.I.:		
Gold ores	VI	197
Mineral industry:		
Progress during 19th century, notes by MILLER	VI	21–46
Mineral manures:		
Notes by MILLER	VI	41
Mineral pigments, *see also* Pigments, *and under* various kinds of Canadian statistics, 1902	VI	454
Mineral pitch, *see* Grahamite.		

* See Summaries, page 107
† " " 55
‡ See Summaries, page 62
¶ " " 81

	Vol.	Page
Mineral production, *see also* Mineral Statistics.		
Aluminium, 1897	III	137
Asbestos, paper by MOLLMAN	V	343 et seq.
Classification of	VIII	170
Coal, 1850-1900, notes by MILLER	VI	31
Copper, costs in Michigan	X	415
Corundum, notes by BAKER	VII	412
Graphite, notes by BRUMELL	X	99–101
Iron, 1809–1900, World's	VI	29
DRUMMOND, paper by, 1898	II	57–61
1899	III	118 et seq.
Mica, notes by CORKILL	VII	297
Nickel, New Caledonia	III	234, 235
	IV	184
	VI	178, 179
Rocky Mts., possibilities of, notes by MACDONALD	VI	339 et seq.
Statistics of, notes by COSTE	VIII	168
Steel from Sweden, 1833–1887	II	41

British Columbia:		
Gold:		
Atlin Dist., 1899–1901	V	32
1900	III	98
Bridge River	III	21
Cariboo, 1899	III	184
Rossland Dist., 1894–1904	VII	47
1897–1901	V	477, 478
Silver-lead:		
Fort Steele Div., 1900	V	511
Slocan Dist., 1892–1901	VI	150
1901	VI	362
to 1906	X	183
ROBERTSON, notes by	V	**572**
Canada:		
1869–1871	IX	95
1871–1904	IX	104
1898	II	212
1899	III	182
1900	IV	292 et seq.
	V	564
1902, notes by BELL	VI	453, 455
1906	X	12
Compared with United States, paper by JOHNSON	VI	66–72
Gold, 1901	V	568
Graphite	X	99
Pyrite, 1904	VI	391
1905	IX	13
WHITE, notes by, on	VI	323
Newfoundland:		
Iron, 1899	III	131
Nova Scotia:		
Coal, 1899	III	188
Iron, 1875–1897	II	52
1900	V	565
and steel, 1902	VI	449
Gold, 1898	II	249
1902	VI	448

	Vol.	Page
Mineral production—Con.:		
Ontario:		
1893–1903	VII	391–392
1899	III	187
1900	IV	300
1901	V	581
1902	VI	463
1903, paper by GIBSON	VII	425–30
notes by PARKS	VII	169
1905	IX	14
Iron, 1900	V	565
Mica, 1899-1903	VII	162
Quebec:		
1898	II	64, 65
1899	III	187, 188
Asbestos, 1900–1901	V	347
Chromite, 1905	IX	35
Iron, 1900	V	565
Yukon:		
1899	III	182
1901	V	574
1898–1901	V	599
Notes by COSTE	III	221, 222
**MINERAL PRODUCTION OF ONTARIO IN 1903,* GIBSON	VII	425–430
Discussion by: COSTE, MORRISON, BROWN, J. S., MILLER, THOMPSON, HOBART, LECKIE	VII	430–434
†*MINERAL PRODUCTION, CANADA AND UNITED STATES,* JOHNSON	VI	66–72
Mineral Products Co., BRIDGEVILLE, N.S.	III	188
Mineral Products Co., HILLSBORO, N.B.	IV	309
Mineral Range Iron Co.	VII	152
Mineral resources, *see also* Economic Geology.		
Eastern Ontario	V	233–255
Rocky Mts., notes by MACDONALD	VI	337
Vancouver Island, B.C.	V	228–232
‡*MINERAL RESOURCES OF VANCOUVER ISLAND,* BREWER	VI	188–199
Mineral specimens:		
Distribution of to schools	VII	436
Mineral springs:		
Trinidad	VI	95
Mineral statistics: *see also* Mineral Production, Statistics.		
Compiling: COSTE, notes by, on	VI	408–410
methods of	VI	456
Mineral veins:		
Bedded structure	II	146
Fissure, example of typical	II	146
Igneous origin of	X	310
Influence of dykes on	II	77, 83
Notes by HILLE	II	84

* See Summaries, page 88
† " " 61
‡ See Summaries, page 65

	Vol.	Page
Mineral veins—Con.:		
Platinum in	VIII	198
"Saddle Reefs"	II	125, 247
Thermal action	II	79
Mineral water:		
Canadian statistics, 1902	VI	454
Quebec & Ontario, classified by HUNT	VIII	89
St. Catherine's, Scotland	VI	79
Mineral wax	VI	77
Miner's inch:		
Definition	X	420
Miners' license:		
British Columbia	III	206
Ontario	III	111
	VII	454
Quebec	VII	455
Yukon	III	215
	IX	117
Mines:		
State ownership of, notes by DOUGLAS	V	151
Mines Act:		
Canada, COSTE's views on	VII	450
Mines' Branch, DEPT. OF INTERIOR:		
Establishment of	IX	101
Functions of	IX	101–103
Mines Inspection Act:		
British Columbia, eight-hour clause	III	172, 173
***THE MINES OF ONTARIO,** CARTER	VII	114–167
Minette dyke:		
Athabasca mine, Nelson, B.C.	V	16
Mingan, SAGUENAY CO. QUE.:		
Iron sands analysis	IV	92
Mining, *see also under* Coal, Ores and Minerals, Drilling, Quarrying, Shaft-sinking, Stoping, Timbering, Tunneling, etc.		
Concrete uses in, notes by LEONARD	VIII	108
Contract system, Rossland, B.C.	V	414
History of, in Rocky Mt. region	VI	339 et seq.
Influence of Government on, paper by KIRBY	VI	363–371
Methods of teaching, McGill University	V	5 et seq.
National importance of, paper by HARDMAN	V	113–125
	V	585
Possibilities in Canada, paper by HOBART	VI	313–316
Relation of geology to	VII	438
Topographic surveying as an aid to	IX	83
Mining bureaus:		
Efficiency	II	254
Nova Scotia	II	254
Provincial, resolution of Institute, respecting	II	255
Mining Commission:		
Appointment in Canada, notes by MACDONALD	VI	350

* See Summaries, page 77

	Vol.	Page
Mining companies, *see also* Joint Stock Companies.		
Over capitalization of, in British Columbia	VIII	243
Dishonest promotion of, notes by GWILLIM	X	321, 322
Mismanagement of, in Algoma District, Ont., notes by BRENT	IV	174–179
Incorporation of, notes by COSTE	X	330
Rainy River Dist., notes by CARTER	VII	128
***MINING AND CONCENTRATION OF CORUNDUM IN ONTARIO,** FAIRLIE	V	164–170
Mining costs, *see* Costs *and* Mine Accounting.		
Mining directors:		
Responsibility of, paper by WILLIAMS	IX	281–284
Mining engineering:		
Proposed legislation affecting, C.S.C.E.	II	256, 259
	III	180
Mining engineers:		
Education of, paper by PORTER	IX	143–179
Legislation affecting	V	561
Registration of in Canada, notes by GWILLIM	X	325
Responsibility of, paper by WILLIAMS	IX	281–284
Mining fees:		
Yukon	III	215
Mining geology, *see also* Economic Geology, Geology, etc.		
Notes by ADAMS	V	588
Mining grants:		
Quebec, regulations respecting	VII	455
Mining industry:		
Australia, Government aids to	V	136
British Columbia, effect of taxation on	V	320
review of 1899	III	183–187
Government duty to, notes by HARDMAN	V	113–125
United States, notes by MACDONALD	VI	339
Mining legislation:		
Alberta-Saskatchewan	V	111
Anthracite coal districts, Pa.	IX	381, 385
British Columbia :		
alien Act, effect of	III	97, 206
Eight-hour law	V	319
MACDONALD, notes by, on	VI	347
mines Inspection Act, in	III	172, 173
Canadian :		
codification of	IX	23
gold dredging machinery duty free into Canada	III	167
improvement of, paper by COSTE	VII	450–466
Mexico:		
Douglas, notes by	V	151
system of, in	VII	478
Ontario:		
1899	III	110
1900, BELL, views of, on	IV	290
CLARK, papers by	III	110–117
		204
	IX	113–114

* See Summaries, page 44

	Vol.	Page
Mining legislation—Con.:		
Ontario—Con.		
discussion on, by, COSTE, FRASER	III	204–5
Gold Mining Act, 1864	III	110
Gold and Silver Mining Act, 1868	III	110
Mining Operations Act, 1896	III	110
Mining Companies' Incorporation Act	III	117
"Orders-in-Council"	III	117
	III	204
Quebec:		
mineral property exempt from municipal taxation	III	181
OBALSKI, notes by	V	154
resolution of Institute respecting	X	20
SJOSTEDT, notes by	V	141
Work of Institute in reference to	VII	31
Yukon:		
complaint respecting	III	204
COSTE, views of, on	V	592
TYRRELL, paper by	IX	115–121
Mining licenses:		
Establishment of, in Ontario	III	110
Mining litigation:		
Caldwell vs. Fraser	II	242
"Great Mines Case" (base metals not prerogative of Crown)	III	113
Mining machinery:		
Canadian statistics	IV	314
	VI	455
Duty on	V	138
	VI	369
***MINING IN THE NORTH-WEST, 1902,** SMITH, F. B.	VI	373–375
Mining plant:		
Notes by GARDE	VI	301–305
†***MINING POSSIBILITIES OF THE CANADIAN ROCKIES,*** MACDONALD	VI	337–354
Mining practice:		
Asbestos	V	351
at Athabasca mine, Nelson, B.C	V	16
in Boundary District, B.C., papers by KEFFER, on	V	213–217
	VII	42–45
Coal, pillar and stall system, modification of	V	109
for Corundum, paper by FAIRLIE	V	164–170
Economies in	III	11–20
Electric drilling	II	182
for Gold ores, Australia	II	247
Nova Scotia	II	126
for Mica, notes by CORKILL	VII	297, 298
skill required in	VII	162
Nickel, New Caledonia	VI	173 et seq.
in Regent iron mines, Mich	VII	323, 324
in Rossland Dist., B.C., notes by KIRBY	VII	57
West Kootenay, B.C	II	82
Mining profession:		
Paper by GWILLIM on status of	X	321–327
Mining pumps, *see under* Pumps.		

* See Summaries, page 72
† " " 70

	Vol.	Page
***MINING PUMPS,** MORGAN	III	145–148
Discussion on, by, FERGIE, HAY, HANSON	III	197–198
†***MINING IN QUEBEC PROVINCE IN 1898,** OBALSKI	II	62
Mining regulations, *see also* Mining Legislation, Alberta, Saskatchewan, Coal.		
Great Britain, respecting safety lamps	V	379
Yukon	III	204, 216
	V	577
Mining rights:		
Quebec	V	154
‡***MINING IN THE ROSSLAND DISTRICT,** CAMPBELL	V	447–483
Mining schools:		
McGill University, Montreal	V	4 et seq.
Mining Society of Nova Scotia:		
Affiliated with Institute	II	198
Joint meeting of, with Institute and A. I. M. E.	IV	3–67
Organization of	VII	28
Mining statistics, *see also* Mineral Production.		
Canada:		
1900, review by BELL	V	563
first compilation of in	IX	94
JOHNSON, paper by	VI	66–72
resolution of Inst. re uniformity of compilation in	II	255
Compiling, notes on, by:		
HARDMAN	V	123
MCAREE	V	137
LeRoi mine, Rossland, B.C.	V	313, 314
Quebec	V	154, 350
Trail Creek, Min. Div., B.C., 1900	V	524
¶***MINING STATISTICS,** HOBART	VIII	162–167
Discussion by COSTE, HOBART	VIII	167–168
Mining students:		
Courses for at McGill University	V	5 et seq.
Mining technology:		
Progress of in XIXth Century	VI	22
Mining titles:		
Beauce gold district, Que.	II	243
Lake of the Woods District, Ont.	II	242
Minnesota, U.S.A.:		
Depth of glacial grist	III	30
Minnesota Geological Survey:		
Report by on freight rates on iron ores	IV	282 et seq.
Minnesota iron ranges:		
Extensions in Canada	IV	282
Report by WINCHELL on	IV	282
Minnewanka Lake, BANFF DIV., ALTA.	VIII	232
Minnitaki Lake, RAINY RIVER DIST., ONT.:		
Gold at	VII	124
Mint:		
Establishment of in Canada:		
advisable	II	257
notes on, by MACDONALD	VI	351
suggestions for	III	214
Seattle, Yukon gold receipts	III	214

* See Summaries, page 23
† " " 7
‡ See Summaries, page 56
¶ " " 98

	Vol.	Page
Minto, Lord:		
Patron of C.M.I.	II	252
Mispickel, *see* Arsenopyrite.		
Missing Link mine, SLOCAN DIST., B.C.:		
Vein	V	12
Missisquoi Bay, LAKE CHAMPLAIN, QUE.:		
Limestone	V	47
Missouri, U.S.A.:		
Lead deposits	X	311
Mistassini Lake, MISTASSINI DIST., QUE.:		
Anthraxolite	VII	253
Iron near	IX	219
Limestone formation at	IX	19
Mitchell tippler:		
Coal Creek Colliery, B.C.	IV	157, 162, 240
Mitchell's shaft, BRUCE MINES, ONT.	X	159
Mixer, C. T.:		
Webster nickel ores assayed by	IX	309
***MODERN BLAST FURNACE LABORATORY AND ITS WORK,** CRAIG	VI	288–300
Discussion on, by:		
LEDOUX, DRUMMOND, G. E., GOODWIN	VI	471, 472
"Mofettes":		
Notes by COSTE	VI	85–87
Mohican mineral claim, LARDEAU DIST., B.C.	VII	101
Moisie, QUE.:		
Blast furnace	IV	91
	VI	12
Iron sands	VIII	137
analysis	IV	92, 93
treatment of	X	270
Moisie Iron Company	IV	91
MOLLMANN, W.:		
†***Asbestos and its Production in Canada***	V	343–357
Molson, J. H. R. & Brothers	VIII	90
Molybdenite:		
Concentration of	V	7
Magneticability of	VII	283
Price	VI	64
Report on by Geological Survey	VI	48
Uses	VI	61
WELLS, paper by	VI	47–65
British Columbia:		
Boundary District	V	369
Kootenay, West	II	75
Rossland District	V	452, 522
Ontario:		
Long Lake	VIII	270
Mines of, notes by CARTER	VII	164
near Napanee	VII	281
Production, 1902	VI	454, 464
1903	VII	392, 429
Tamworth, Ont.	VII	164
Western	VI	334

* See Summaries, page 67
† " " 52

	Vol.	Page
Molybdenite—Con.:		
Quebec:		
Lake Kewagama	X	106
Occurrences	II	63
Yukon:		
Whitehorse	VIII	179
***MOLYBDENITE, ITS OCCURRENCE, CONCENTRATION AND USES,** WELLS	VI	47–65
Molybdenum:		
Method of estimating in ores	VI	60
MILLER, notes on, by	VI	40
Price	VI	63
Molybdenum steel	VI	62
Monarch mineral claim, BOUNDARY DIST., B.C.:		
Mineralization	V	173
Monazite:		
Concentration of	VI	14
Lievre River, Que	IX	72
MILLER, note on, by	VI	43
Separation of	V	9
Villeneuve, Que	IX	72
Mond, Ludwig:		
Views on Canadian nickel industry	III	229–233, 240
Mond Nickel Company, VICTORIA MINES, ONT.:		
BELL, notes by	IV	300
CARTER, notes by	VII	149, 150
Reduction works at Whitefish, Ont	IV	301
Smelting plant	V	579
Min. ref	VII	425
Mond nickel process	III	231, 234, 236, 238, 239
Monitor mine, SLOCAN, B.C.	VII	372
Montague mine, N.S.	II	163
Montana claim, CONRAD, Y.T.:		
Silver vein on	X	212
Montana creek, WINDY ARM, Y.T.	IX	52
Montana silver mine, WINDY ARM, Y.T.:		
Vein on	IX	50
Workings at	IX	51
Montana veins, SAN MIGUEL PERAS, MEXICO	VIII	274
Monte Amiata, TUSCANY:		
Quicksilver mining at	II	16
Monte Cristo mine, ROSSLAND, B.C.:		
Production, 1894–1904	VII	47
Monteith & Fullbright nickel tracts, WEBSTER, N. CAROLINA	IX	305
Monteregian hills, QUE.	VIII	86
Grain of rocks	IX	212
Montezuma concentrator, SLOCAN DIST., B.C.	VI	152
Montezuma copper claim, PRINCE WILLIAM SOUND, ALASKA	X	200
Montgomery, Prof. H.:		
Discussions by, on:		
The Geological Survey of Canada as an Educational Institution	VII	441
The Undeveloped Mineral Resources of Ontario	VII	395

* See Summaries, page 60

	Vol.	Page
Monographs:		
U. S. Geological Survey	v	121, 139
Mont Calvaire, OKA, QUE.	viii	86
Monteagle Tp., HASTINGS CO., ONT.:		
Molybdenite	vi	50
Montreal, Que.:		
Artesian Wells, paper by ADAMS	viii	76–97
Establishment of branch of Quebec Dept. of Mines at	vi	482
Geological survey established in	x	345
Govt. assay office at	v	154
Meetings of C.M.I. at, 1898	i	19, 33
1899	ii	195–258
1900	iii	175–249
Montreal-London Company	ii	249
Montreal Mining Company:		
Bruce mines acquired by	x	149
Mining by, Lake Superior	x	400
Montreal Plumbago Company	x	90
Monzonite:		
Note by KEMP	x	255
Petrographical peculiarities	ii	74
Rossland Dist., B.C.	v	519
Moore, Thomas:		
Analyses by, of New Caledonia chromite	vi	172
Moore iron mine, HASTINGS CO., ONT.	vii	152
Moore's Point, BOISDALE HILLS, C.B.	vi	414
Moose Lake, MANITOU DIV., ONT.:		
Formation at	viii	184
Moose Mt. coalfield, ALTA.:		
Coal, hardness	x	232
seams	x	231, 232
Moose River, JAMES BAY, ONT.:		
Coal analysis	viii	237
Gypsum at	vii	166, 387
Mooseland, HALIFAX CO., N.S.:		
Gold, occurrence	ii	125, 248
***MORE NOTES ON STAMP MILL PRACTICE,** DEKALB	ix	64–71
Morehead Lake, QUESNELLE DIV., B.C.	x	420
Morenzi, ARIZONA:		
Copper, occurrences	x	254
MORGAN, C. E.:		
†***Mining Pumps***	iii	145–148
Morgan, J. De:		
Report by on naptha, Persia	vi	108
Morgan Farm furnace, MICHIGAN:		
Charcoal consumption	ii	46
Morice River, SKEENA DIV., B.C.:		
Coal, analysis	x	224
discovery	x	223
Mineral-bearing rocks	x	221
Morin, General	x	97
Moriss, J.:		
LeRoi mine located by	v	447
Morley, ALTA.:		
Coal on	x	234

* See Summaries, page 112
† " " 23

	Vol.	Page
Morning Star mine, SLOCAN DIST., B.C.	V	12
Morrison, Llewellyn:		
Discussions by on:		
Chlorination of Gold Ores of the Brookfield Mine, N.S.	VII	318
The Mineral Production of Ontario in 1903	VII	431
The Occurrences, Production and Uses of Mica	VII	304
Morrison mine, BOUNDARY DIST., B.C.:		
Tremolite	V	369
Morrissey, CROWSNEST COALFIELD, B.C.:		
Coal, analyses	VI	230, 231
	VII	504
	VIII	237
fuel ratio of	X	230, 232
measures	IV	232
	VI	230
seams	VII	502–504
Mortar:		
Constituents of, for mine bulkhead	VII	82
Mortar liners	IX	67
Mortars:		
Ben d'Or mine, Bridge River, B.C.	II	36
Cross-section and plan	II	56
Deloro mine	IV	144
Design for	II	150, 151
Dufferin mine, N.S.	II	102
Introducing feedwater to	II	54, 233
Types	II	36
Mortimer-Lamb, H., *see* Lamb, H. Mortimer-.		
MOSCOVICI, ARMAND:		
***Notes on a Deposit of Nickeliferous Pyrrhotite at Malachite Point**	IX	221
Moss Tp., THUNDER BAY DIST., ONT.:		
Sylvanite	VI	334
Mother Lode mine, BOUNDARY DIST., B.C.:		
Gold values	V	373
Notes on, by:		
BROCK	V	367
CORLESS	V	515
KEFFER	VII	42
LEDOUX	V	174
WICKWARE	IX	332
Ore Deposits and Methods of Mining, paper by KEFFER	V	213–217
Motors:		
Diesel	II	167
For electric drills	II	180
Moule, M.:		
Quoted on S. Africa diamantiferous formation	VI	79
Moulton Hill copper mine, ST. FRANCIS RIVER, QUE.	V	82
Mt. Andrew copper claim, KASAAN PENINSULA, ALASKA	X	202
Mt. Bischof, TASMANIA:		
Tin deposit	VI	35
Mt. Brenton, VANCOUVER ISLAND, B.C.	VI	189
Schist formation at	IX	47

* See Summaries, page 119

	Vol.	Page
Mt. Etna, SICILY:		
Eruption	VI	83
Mount Johnson, MONTEREGIAN HILLS:		
Grain of rocks on	IX	212
Mt. Mallahat, VANCOUVER ISLAND, B.C.	VI	189
Mount Morgan, QUEENSLAND:		
Gold discovery	VI	26
Mt. Morgan gold mine, QUEENSLAND:		
Copper at depth in	X	255
Mount Pelee, MARTINIQUE ISLAND:		
Eruption	VI	80
Mount Royal, MONTREAL, QUE.:		
Formation of	VIII	86
Mount Sicker Dist., VANCOUVER ISLAND, B.C.:		
BEST, notes on, by	V	229
Copper mining in	X	204
ores	VI	189
	IX	45
Mt. Skerrit, VANCOUVER ISLAND, B.C.:		
Copper ores	VI	189, 193
Mt. Triano, SOMORROSTRO DIST., SPAIN:		
Iron ore deposit at	IV	198
Mt. Zibio, ITALY:		
Petroleum springs	VI	86
Mountain iron mine, LAKE SUPERIOR:		
Analyses	II	50
Mountain Lion Gold Mining Co., REPUBLIC, WASH:		
Gold milling and cyaniding	V	275–279
	VII	195
Mountain Rose claim, BOUNDARY DIST., B.C.:		
Pyrrhotite on	X	189
Moyie, B.C.:		
Silver-lead ore	V	511
Moyra Sound, ALASKA:		
Copper mining on	X	204
Moxham, A. J.		
Address of welcome to Institute	IV	13
Muckers:		
Wages of, Rossland Dist., B.C.	V	458
Mud volcanoes:		
Notes on by COSTE	VI	86
Mueseler safety lamp	V	380, 382
	VI	200
Muffle furnace:		
Assaying lead ores in	IV	225 et seq.
Oil:		
BRENT, notes by, on	V	288 et seq.
Diagram	V	293–295
Mulhausen, ALSACE, GERMANY:		
Graphite at	X	89
Munroe oil-well, ONONDAGA CO., N.Y.	VI	97
Pressure	VI	112
Murcia Province, SPAIN.		
Murphy reversible fan	IV	239
Murray, Alexander:		
Appointed assistant to Logan	IX	88
Appointment to Geological Survey	X	343
Min. ref.	VII	418

	Vol.	Page
Murray Bay, Charlevoix Co., Que.:		
Cleveite from	VII	251
	IX	72
Murray, Hon. George:		
Address by, at Halifax meeting of Institute	IV	49
Murray, J. C.:		
Min. ref.	X	12
Murray nickel mine, Sudbury, Ont.:		
Acquired by Vivians	VII	499
Discovery of	VII	495, 496
Opening of	III	225
Ore deposits	V	529, 542
Platinum in ores of	VIII	204
Muscovite: *see also* Mica.		
British Columbia	VII	303
British East India	V	244
Corkill, notes by	VII	284
Effingham Tp., Ont.	VII	289
Occurrences	VI	45
Pike Lake, Ont.	VII	163
Museum:		
of Economic Geography, notes by White	VI	319
Functions of	VIII	68
Need of in Ontario, paper by Parks	VIII	68–73
National Canadian	IV	72
MUSGRAVE, E. C.:		
****A Prospecting Trip in Northern Omenica, B.C.***	III	90–96
Muskoka Dist., Ont.:		
Peridotite rocks in	IX	126
Muskoka River, Ont.:		
Allanite	VII	254
Mussen, W. H.:		
Maps by of Athabasca mine Nelson B.C.	V	20
Myrtle mines, Slocan Dist. B.C.	V	12

N

Nacozari gas generator:		
Analyses of product	V	180
Nagant, H.	IX	72
Nagle horizontal engine	IV	171
Nakety, New Caledonia:		
Noumeaite, analyses	IX	307
Nanaimo, B.C.:		
Coal mining, notes by Brewer	VI	188
Nanoose Bay, Vancouver Island, B.C.:		
Formation	VI	195
Nantel & Goyer	VIII	95
Napanee, Ont.:		
Iron deposit near, concentration tests	VII	281

* See Summaries, page 19

	Vol.	Page
Naptha:		
Kurdestan, Persia	VI	108
Origin, Mendeljeff's views on	VI	123
Napthalene:		
Use, indigo manufacture	V	145
Nastapoka Islands, HUDSON BAY, LAB.:		
Iron-bearing rocks, paper by MICKLE	V	256–264
Natashqua Magnetic Iron Co.	IV	92, 94
***NATIONAL IMPORTANCE OF MINING,** HARDMAN	V	113–125
Discussions on:		
MEISSNER, CAMPBELL-JOHNSTON, HUNGERFORD, MCAREE, GWILLIM, SJOSTEDT, GOODWIN, MCEVOY, DONALD, WELLS, DOUGLAS, OBALSKI	V	125–155
ADAMS, BLAKEMORE, BELL, R., BELL, B. T. A., COSTE, HAANEL, DREWRY, HARDMAN, PORTER, MCEVOY, INGALL, GOODWIN, CAMPBELL, G., ADAMS, R. C., GIBSON	V	585–597
National Tube Works, MCKEESPORT, PA.:		
Pipe bursting tests by	VIII	54
threading tests by	VIII	52
Native amalgam	II	13
Native copper, *see* Copper.		
Natural cement, *see* Cement.		
Natural gas:		
Appalachian, formation	VI	109, 110
Broxburn, Scotland	VI	79
in Carboniferous rocks	III	81
Classification of, as mineral	III	208
in Clinton formation	III	80
in Devonian formation	III	81, 82
in Guelph formation	III	80
Hydrostatic theory	III	84
Localization of, in productive areas	III	81, 87
Maisonneuve, Que.	VIII	98
in Medina formation	III	79, 80
Ohio and Indiana, analysis	VI	101
Onondaga Co., New York	III	80
Origin of	III	78
	VI	73–128
Oswego Co., New York	III	80
Pressure	III	83
	VI	99, 112
"Sands," definition of term	III	80
Santa Barbara, Cal.	VI	95
in Silurian rocks	III	82
Strata in which found	III	80
Sulphuretted hydrogen in	X	78
in Trenton formation	II	211
	III	80
Virginia, West	III	81
Ontario:		
Discovery of, in	III	68
Localities	III	68
Occurrences, notes by GIBSON	VII	392

* See Summaries, page 43

	Vol.	Page
Natural gas—Con.		
Ontario—Con.:		
Production:		
1900	IV	304
1901	V	581
1902	VI	464
1903	VII	427, 430
1893–1903	VII	392
Raleigh Tp., Kent County	X	78
Tilbury, analysis	X	79
Wells	III	68, 69
Western	II	186, 208
***NATURAL GAS IN ONTARIO,** COSTE	III	68–69
Discussion on, by:		
BLUE, BELL, GOODWIN, CLARK	III	207–208
Natural gas companies:		
Ontario Natural Gas Co.	III	68
Provincial Natural Gas and Fuel Co. of Ontario	III	69
Union Gas Co.	III	71
Natural gas wells:		
New York strata, U.S.A.	III	80
Ontario:		
Amherstburg	III	74
Desjardin's farm	III	72
Logs:		
Bertie Tps.	III	75, 76
Colchester E. Tp	IV	73
N. Tp	III	71
Coste, No. 1	III	70
Gosfield Tp.	III	70
Tilbury W. Tp.	III	72
Willoughby Tp	III	77
Maidstone Tp.	III	74
Provincial Natural Gas Co.	III	75–78
Ruthven, depth and production	III	68
St. Catharine's	III	80
Welland, depth and production	III	69
Woodbridge Farm, Essex Co.	III	73, 75
Natural pitch, *see* Ozocerite.		
Natural resources:		
British Columbia statistics, 1906	X	187
Navarre Province, SPAIN:		
Iron ore	IV	196
Navy, British:		
Crowsnest coal used by	IV	236
†***THE NEED OF A PROVINCIAL MUSEUM IN ONTARIO,***		
PARKS	VIII	68–73
Discussion on, by:		
WALKER, STAIRS, GOODWIN, SMITH	VIII	73–75
‡***ON THE NEED OF A TOPOGRAPHICAL SURVEY OF THE DOMINION OF CANADA, PARTICULARLY WITH REFERENCE TO THE DEVELOPMENT OF THE ECONOMIC RESOURCES OF THE DOMINION,***		
ADAMS	IX	74–86

* See Summaries, page 18
† " " 94
‡ See Summaries, page 113

	Vol.	Page
Neepawa mine, SLOCAN DIST., B.C.:		
Vein	v	12
Negaunee, MICH., U.S.A.:		
Iron mining near, paper by ATKINSON	vii	319–334
Neill, James W. :		
Copper leaching, process of	iv	123–125
Nellore Dist., MADRAS, INDIA:		
Mica mines	vii	284, 287
Nelson, W. J.:		
Death	iii	179
Nelson, B.C.:		
Athabasca gold mine near	v	15 et seq.
Granite at	v	508
Lead smelting practice at	ix	58
Meeting of Institute at, 1899	iii	166
1902	vi	437
Nelson Dist., B.C.:		
Gold ores of, notes by CORLESS	v	525
Minerals in	ii	76
Mining in, 1900	iv	295
Rocks	v	506
Nelson & Fort Sheppard Railway, 1893:		
Construction of	iii	3
Neo-Carboniferous strata:		
Pictou Co., N.S.	v	358 et seq.
Nepheline-syenite, *see also* Syenite.		
Ontario:		
Corundum deposits in	vii	417, 419
Eastern	iii	200
Hastings Co.	v	164
Nephelite:		
Peterborough Co., Ont.	vii	305
Net Lake, TIMAGAMI DIST., ONT.:		
Iron pyrite at	vii	159
Jaspilyte	iv	278
Pyrite at	x	124
Nettie L. silver-lead mine, FERGUSON, B.C.:		
Notes on by BROCK	vii	97
Nevada, U.S.A.:		
Goldfield District, paper by JENNINGS	viii	39–45
New Alameda, CAL., U.S.A.:		
Quicksilver	vi	35
New Annan, N.S.:		
Copper at	iii	189
A NEW AREA OF COPPER-BEARING ROCKS IN THE EASTERN TOWNSHIPS OF THE PROVINCE OF QUEBEC, DRESSER	vii	397–399
Discussion by:		
LECKIE, COSTE	vii	400
New Caledonia:		
Nickel industry	iii	227, 235
production, 1889-1897	iii	234, 235
New Brunswick:		
Albertite	vi	105, 106, 113

* See Summaries, page 86

	Vol.	Page
New Brunswick—Con.:		
Coal production, 1900	V	564
1902	VI	445
Copper production, 1901	V	568
Graphite in	X	86
Mineral production, 1869–1871	IX	95
1899	III	182
1900	IV	293, 309
	V	564
1901, note by BELL	V	582
1902	VI	454
Mining laws, notes by COSTE	VII	455, 463
Molybdenite occurrences	VI	48
New Bulfontein diamond mine, S. AFRICA	V	62
New Caledonia:		
Genthite, analysis	IX	307
Nickel:		
analysis	IX	310
deposits	V	542
	VI	169–179
		483–486
mining, notes by MILLER	VI	38
production, 1900	V	528
Nickel-silicates, analysis	IV	185
***NEW DISCOVERIES IN NORTHERN QUEBEC,** OBALSKI	X	105–107
New England Gas & Coke Works, EVERETT, MASS	III	188
New Glasgow, N.S.:		
Coal-bearing shales	V	358
Conglomerate	V	359
New Hampshire:		
Mica occurrences	VII	287
†***ON A NEW OR HITHERTO UNRECOGNIZED GEOLOGICAL HORIZON IN THE GAS AND OIL REGION OF WESTERN ONTARIO,** AMI	II	186–191
Discussion on, by:		
AMI, INGALL	II	208–211
New Klondyke, RAINY RIVER DIST., ONT	VI	331
‡***A NEW MATTE SEPARATOR,** HEDLEY	IX	58–63
¶***A NEW MINING DISTRICT IN THE NORTH OF QUEBEC,** OBALSKI	VIII	363–366
Discussion on, by:		
COSTE, CIRKEL, HOPPER	VIII	366–367
New South Wales:		
Gold discoveries in	VI	26
Government metallurgical works	V	136
Noumeaite	IX	308
Platinum in	VIII	197
‖***THE NEW TILBURY & ROMNEY OIL FIELDS OF KENT COUNTY, ONTARIO,** COSTE	X	77–84
New Vancouver Coal Co., NANAIMO, B.C	VI	188
New York State:		
Glacial grist, depth of	III	30
Oilfields	VI	100, 111

* See Summaries, page 131
† " " 14
‡ " " 111
¶ See Summaries, page 108
‖ " " 129

	Vol.	Page
New Zealand:		
Gold dredging in, methods	VI	469
returns	IV	298
	V	96
Newcastle, VANCOUVER ISLAND, B.C.	VI	188
Newfoundland:		
Coal in	IV	23
Geological similarities of iron-bearing districts to Lake Superior region	II	67
Meeting of Institute at	IV	3, 60–67
Iron:		
deposits	II	39
discovery of on Bell Island	II	66
exports, 1898	II	60
1900	V	566
Mineral production, 1865–71	IX	95
Molybdenite occurrence	VI	51
Oil-gas "sands"	VI	110
Pyrite deposits	VI	391
Niagara Falls, ONT.:		
Carborundum manufacture at	VII	420
Natural gas	III	68
Niagara formation:		
Essex Co., Ont., salt water invariably found in	III	75
"Leptocalia Intermedia"	II	210
Oil and gas in	VI	112
Tilbury oilfields, Ont.	X	82
Western Ontario	II	187, 208
		209
Niblack Copper Co., PRINCE OF WALES ISLAND, ALASKA:		
Mining operations of	IX	48
Niccolite:		
Quebec	II	63
Sudbury Dist., Ont.	V	235
Wallace mine, Ont.	III	224
Nichols Chemical Co., CAPELTON, QUE.	IV	308
Nicholls & James	IX	58
Nickel:		
Alloys of:		
notes by MILLER	VI	37
New Caledonia	VI	178
with steel	V	550
	VI	38
Associated with chrome iron	IV	184
Chloridization of, paper by RUTHERFORD	VIII	336–342
Discovery of	VI	36
in Canada	II	62
	III	224
	VII	494 et seq.
Electrolytic refining:		
Andree process	V	204
Hoepner's process	III	245
notes by KOEHLER	V	189, 193
		203
Ulke process	V	393 et seq.
Magnetic separation	IV	188

	Vol.	Page
Nickel—Con.:		
Ores:		
genetic relations of, paper by DICKSON	IX	236–260
microstructure of, paper by CAMPBELL & KNIGHT	X	274–280
Prices:		
1878	III	224
1892–1899	III	244
Properties of	V	550
Refining:		
Mond process	III	231, 234
		236, 238
		239
Orford process	III	225, 245
relative cost of	III	234
Smelting:		
Bartlett-Thompson process	V	192
Uses	V	248, 550
World's production, 1900	V	528
British Columbia:		
Atlin dist	III	100
Fort Steele Dist	III	225
Rossland Dist	V	451, 522
	VII	51, 67
Vancouver Island	IX	48
Canada:		
Effect of U.S. import duty on refined	III	235, 236
Export duty:		
COSTE's views on	VII	32
LEDOUX views on	IV	189
MOND's views on	III	229–233
History, 1892–1899	III	224
Paper by EVANS	VII	494
New Caledonia, competition, effect of	III	239
Smelting, first attempts at	III	224
Statistics:		
1889–1897	III	234, 235
1906	X	12
Canada & New Caledonia, 1901	IV	184
Taxation of	III	226–248
	IV	301
Germany:		
Sohland, notes by DICKSON	IX	236 et seq.
New Brunswick:		
St. Stephen, analysis	III	225
notes by DICKSON	IX	236 et seq.
New Caledonia		
Analysis	IV	185, 188
	IX	310
English capital invested in	III	227
Freight charges to New York	IV	189
Mines of:		
paper by LECKIE	VI	169–179
		483–6
note by SILVER	V	542
production	III	232
1889–1897	III	234–235
1900	V	528

Nickel—Con.:	Vol.	Page
Norway:		
Deposits	v	538
paper by LECKIE	vii	401–409
VOGT'S views on origin of	viii	207
	x	278
Ores	iv	189
Nova Scotia:		
Lunenburg Co.	iii	226
Ontario:		
Atikokan, notes by HILLE	ix	285–301
CARTER, notes by	vii	148–155
Cobalt Dist.	x	76
Discovery in, paper by EVANS	vii	494 et seq.
Eastern	iv	269
Nipissing Dist.	iv	277
Occurrences, notes by MILLER	vii	381
Refining, Sault Ste. Marie	v	208
Resources and industry, notes by MILLER	v	235 et seq.
Statistics:		
1893–1903	vii	392
1900	iv	300, 304
	v	528
1901	v	581
Matte	v	569
1902	vi	454, 464
		465
1903	vii	425, 429
1905, notes by MILLER	ix	14
Sudbury Dist.:		
analysis	iii	225
concentration	vii	279, 282
deposits, description of	v	235 et seq.
discovery in	vii	494
notes by CARTER	vii	148 et seq.
origin	iv	270
notes by COLEMAN	x	310
proposal to use in steel rails	iii	194
SILVER, paper by	v	528–551
Work of Geological Survey in	v	121
Quebec:		
Analyses	ii	63
Chibougamau Dist.	ix	221, 222
Discovery in	ii	62
United States:		
Carolina, N., Webster, paper by BARLOW	ix	303–316
Nevada, arsenides of	iv	185
Oregon, Douglas Co., paper by LEDOUX	iv	184–189
Nickel Copper Co., HAMILTON, ONT.:		
Exhibit Buffalo Exposition	v	254
Nickel Corporation, Ltd., NEW CALEDONIA:		
Formation of	iii	232
Property	iii	239
NICKEL DEPOSITS IN NEW CALEDONIA, LECKIE	vi	169–179
Discussion by:		
LECKIE, COSTE, SMITH, G. R., MILLER, FERGIE, BROCK	vi	483–486

* See Summaries, page 63

	Vol.	Page
***ON THE NICKEL DEPOSITS OF NORWAY,** LECKIE	VII	401–408
Discussion by, on:		
LECKIE, COSTE, OBALSKI, BROWN, J. S.	VII	408–409
†***ON THE NICKEL DEPOSITS OF WEBSTER, WESTERN NORTH CAROLINA,** BARLOW	IX	303–316
"Nickel-gymnite" *see also* Genthite	IX	306
Nickel Lake, WATTEN TP., R. R. DIV., ONT.:		
Pyrite at	VIII	158
	X	125
Nickel Plate mine, ROSSLAND, B.C.:		
Air-compressing plant	VI	182
Notes by THOMPSON	VII	85
Vein	V	522
Nickel-steel:		
Composition	VI	38
Properties	V	550
Rails, proposed Canadian industry	III	194
Nicola, B.C.:		
Coal analysis	VIII	237
Coalfields	VI	226, 227
Copper in	IV	229
	VIII	174
Nicolet Seigniory, NICOLET CO., QUE.:		
Mineral springs	VIII	91
Nictaux, ANNAPOLIS CO., N.S.:		
Iron ores	V	584
Nino mineral claim, DEER LAKE, RAINY RIVER D., ONT.	VI	332
Niobrara formation:		
Belle Plain, near Regina, Sask.	VIII	241
Nipigon Lake, THUNDER BAY DIV., ONT.:		
Iron ore near	IV	281
mining	VII	154
Nipissing Dist., ONT. *See also* Cobalt.		
Iron ranges	IV	275
	VII	257
Jaspilyte	IV	278
Pyrite	IV	276, 277
Vermilion River, gold-bearing sands	II	105
Nipissing silver mine, COBALT, ONT.:		
Formation at, notes by BELL	X	67
Nischny Tagilsk Dist., RUSSIA:		
Platinum in	VIII	193, 196
Nisconlith series:		
West Kootenay, British Columbia	V	506
Ymir mine, Ymir, B.C.	V	525
Nitre:		
Action as flux	V	42
Nitro-glycerine:		
Introduction of in mining	VI	23
Nitrous acid gas	VI	402
Noble Five mine, SLOCAN DIST., B.C.:		
Concentrator	VI	152
Nome, ALASKA:		
Goldfields, Schrader & Brooks' report	V	140

* See Summaries, page 86
† " " 123

	Vol.	Page
Nordbottom Province, SWEDEN	II	39
Nordenskiol River, YUKON RIVER, Y.T.:		
Coal on	X	216
Norfolk County, ONTARIO:		
Bog iron ore	IV	265
Norite:		
Sudbury Dist., Ont.	V	529
	VII	63
Norland, VICTORIA CO., ONT.:		
Molybdenite near	VII	164
North American Graphite Co.:	X	91
North American Trading and Transportation Co.:		
Cliff Creek, Y.T.	IV	297
North American Transportation Co.:		
Fleet of	V	600
North Bay, ONT.:		
Suggested by HIXON as smelter site	X	76
North Brookfield, N.S., *see* Brookfield gold mine.		
North Burgess, *see* Burgess Tp., Ont.		
North Carolina, U.S.A.:		
Copper occurrence	X	255
Corundum in	III	200, 201
	V	165
	VII	410, 411
		417
Diamonds in	III	151
Mica	VII	287
Nickel deposits in	IX	303–316
Platinum in	VIII	199
North Crosby, LEEDS TP., ONT.:		
Molybdenite	VI	50
North Dakota, U.S.A.:		
Gas tests on coals from	IX	325
Steam tests on coals from	IX	322
North Elmsley Tp., LANARK AND LEEDS COS., ONT.:		
Graphite in	X	91
"North Fault":		
Pictou coalfield, N.S.	V	358 et seq.
section	V	363
North Fork of Kettle River, YALE DIV., B.C.:		
Formation	V	514
North Kootenay Pass, B.C.:		
Thickness of cretaceous formation	IV	233
North Nickel Range, SUDBURY DIST., ONT.:		
Minerals in ores from	X	277
THE NORTH SHAFT MINE OF THE SUSQUEHANNA COAL CO., AT NANTICOKE, PA., WINTER	IX	375–386
North Star mine, KIMBERLEY, B.C.:	V	511
Notes on ore deposit, by CORLESS	V	512
North Star mineral claim, POPLAR CREEK DIST., B.C.	VII	104
North Star nickel mine, SUDBURY DIST., ONT.:		
Formation at	IX	225
North Sydney, C.B.:		
Coal mine at	IV	35, 61
North Thompson, B.C.:		
Coal analysis	VII	424

* See Summaries, page 125

	Vol.	Page
North Thompson River, B.C.:		
Gold dredging	v	91, 95
North-West Territories, *see also* Alberta, Assiniboia, Indian Territories, Saskatchewan, Yukon.		
Area	v	104
Coal mining, 1902, report by SMITH, F. B.	vi	373–375
paper by SMITH, F. B.	v	104–112
Gold-dredging	v	577
production, 1901	v	568
Mining regulations, 1898, re accidents	v	111
Northern Mt., SELKIRK MTS., B.C.	vii	93
Northern Navigation Company:		
Fleet of	v	600
Northey pump:		
Description of sinker	iii	145
Operating results	iii	128, 129
Northport smelter, WASH., U.S.A.		
Enlargement	v	322, 339 340
Establishment of	v	311
Freight charges on ore to	v	316
Marketing, costs	v	341
Treatment charges	v	312
Norton furnace:		
Utilizing saw mill waste in iron making	ii	50
Normandale, NORFOLK COUNTY, ONT.:		
Iron	iv	265
Norway:		
Askim:		
Copper-nickel deposits	vii	404
nickel mines	vii	407
Drammen	vii	405
Evje:		
copper-nickel deposits	vii	404
	viii	207
Flaat nickel mine, ores of	viii	207
Fahlbands, notes on by LECKIE	vii	401, 406
Fieldskuldnaes, copper-nickel deposit at	vii	402
Foeoe Island, copper-nickel deposits	vii	403
Glommen River	vii	407
Kongsberg silver mine, notes by LECKIE	vii	401
Kristiana District, copper ores	v	371 et seq.
Littland, copper-nickel deposits	vii	402
Nickel deposits	v	538
	vii	401–409
	viii	207
notes by CAMPBELL and KNIGHT	x	278
Platinum occurrence in	viii	209
Radio-active minerals found in	vii	254
***NOTABLE CANADIAN DEPOSIT OF CHROMITE, A.** DONALD	ii	25–26
†***NOTES TO ACCOMPANY ONE PLAN AND THREE VERTICAL SECTIONS OF THE ATHABASCA MINE, ON TOAD MOUNTAIN, NEAR NELSON, BRITISH COLUMBIA,*** FELL	v	15–20

* See Summaries, page 4
† " " 37

	Vol.	Page
NOTE ON ASBESTOS MINING IN ASIATIC RUSSIA, REIHLE	VI	372
†*NOTES ON ATLIN GOLD FIELDS,* GWILLIM	III	97–101
Discussion on, by COSTE	III	205–207
‡*NOTES ON THE BRITISH COLUMBIA ZINC PROBLEM,* GARDE	VII	368–373
Discussion by: GWILLIM, MILLER, COSTE, KIRKPATRICK, SNYDER	VII	373–376
¶*NOTES ON CONCRETE,* LEONARD	VIII	102–110
*1*NOTES ON THE CONSTRUCTION OF MINE BULKHEADS,* THOMPSON	VII	82–86
†1*NOTES ON CRUSHING AND SIZING IN THE ORE-DRESSING LABORATORIES OF McGILL UNIVERSITY,* PORTER	IV	205–223
‡1*NOTES ON A DEPOSIT OF NICKELIFEROUS PYRRHOTITE AT MALACHITE POINT,* MOSCOVICI	IX	221
Discussion by: HARDMAN, DICKSON, LOW	IX	222
¶1*NOTES ON DIAMOND DRILLING IN THE BOUNDARY DISTRICT,* KEFFER	IX	317–320
*2*NOTES ON THE DRIVING OF SIMPLON TUNNEL, SWISS ALPS,* MEYER, L.	II	137–142
†2*NOTES ON THE ECONOMIC MINERALS OF VANCOUVER ISLAND, B.C.,* BEST	V	228–232
‡2*NOTES ON THE GEOLOGY AND A FEW ORE DEPOSITS OF SOUTH EASTERN BRITISH COLUMBIA,* CORLESS	V	503–527
¶2*NOTES ON THE GEOLOGY OF THE NORTHERN PORTION OF THE BOISDALE HILLS ANTICLINE,* BORIGHT	VI	411–434
*3*NOTES ON GOLD-DREDGING, A FEW.* CLARKE	V	87–103
†3*NOTES ON GOLD MILLING PRACTICE AT THE ATHABASCA MINE, NELSON, B.C.,* FELL	IV	83–90
‡3*NOTES ON THE GOLD ORES OF WESTERN ONTARIO,* BRENT	VI	327–335
¶3*NOTES ON GRAPHITE, ITS OCCURRENCES, USES AND PRODUCTION,* BATEMAN	VIII	343–347
*4*NOTES ON THE HISTORY OF THE MINERAL INDUSTRY IN THE NINETEENTH CENTURY,* MILLER	VI	21–46
†4*NOTES ON INCREASED FACILITIES AT WABANA IRON MINES,* CHAMBERS	III	130–132
‡4*NOTES ON THE IRON ORE DEPOSITS OF BILBAO, NORTHERN SPAIN,* ADAMS	IV	196–204
¶4*NOTES ON A LABORATORY AMALGAMATING DEVICE AND COMPARISONS WITH ACTUAL MILL RESULTS,* GUESS	I	10

*	See Summaries, page		71	‡2	See Summaries, page		57
†	"	"	19	¶2	"	"	73
‡	"	"	84	*3	"	"	42
¶	"	"	96	†3	"	"	24
*1	"	"	76	‡3	"	"	69
†1	"	"	33	¶3	"	"	107
‡1	"	"	119	*4	"	"	59
¶1	"	"	124	†4	"	"	22
*2	"	"	11	‡4	"	"	32
†2	"	"	47	¶4	"	"	1

	Vol.	Page
***NOTES ON THE LIFE HISTORY OF COAL SEAMS,** Gwillim	VIII	235–240
Discussion by: Dowling, Coste, Garde	VIII	236–243
†***NOTES ON THE LIMESTONE OF THE PHILIPSBURG RAILWAY & QUARRY CO.,** Donald	V	47–48
‡***NOTES ON MACHINERY CONSTITUTING A MINING PLANT,** Garde	VI	301–305
¶***NOTES ON THE MAGNETIC IRON SAND OF THE NORTH SHORE OF THE ST. LAWRENCE,** Obalski	IV	91–98
*1***NOTES ON THE MILLING OF GOLD IN REPUBLIC, WASH.,** Cirkel	V	274–287
†1***NOTES ON MINING AND SMELTING IN THE BOUNDARY DISTRICT, B.C.,** Keffer	VII	42–45
Discussion by: Miller, Brock, Coste	VII	45–46
‡1***NOTES ON THE OCCURRENCES, PRODUCTION AND USES OF MICA,** Corkill	VII	284–303
Discussion by: Miller, Fraleck, Obalski, Morrison, Adams	VII	303–307
¶1***NOTES ON THE OCCURRENCE OF QUICKSILVER IN CANADA,** Colquhoun	II	13
*2***NOTES ON OIL FURNACES FOR ASSAYING AND MELTING,** Brent	V	288–295
†2***NOTES ON THE OREGON NICKEL PROSPECTS,** Ledoux	IV	184–189
‡2***NOTES ON THE PRODUCTION AND USES OF CANADIAN CHROME,** Edwards	IX	35–38
¶2***NOTES ON REVERBERATORY FURNACE SMELTING AT ANACONDA,** Hamilton	VIII	349–357
*3***NOTES ON ROASTING WITH McDOUGALL FURNACE,** Sorensen	VI	306–316
†3***NOTES ON SOME DEPOSITS IN THE EASTERN ONTARIO GOLD BELT,** Knight	VII	210–244
‡3***NOTES ON SOME WESTERN COALS,** Gwillim	VII	422–424
¶3***NOTES ON SOME WORK RECENTLY DONE IN THE MINING LABORATORIES OF McGILL UNIVERSITY,** Porter	V	3–9
*4***NOTES ON THE SPECIAL FEATURES OF COAL MINING IN THE CROW'S NEST, B.C.,** McEvoy	VII	500–504
†4***NOTES ON THE UTILIZATION OF POOR COALS AND SLACK,** Dowling	IX	321–326
Discussion by: Leckie, R. G., Ingall, Smith, G. R.	IX	327–330
‡4***NOTE ON VARIETIES OF SERPENTINE IN SOUTHEASTERN QUEBEC, A,** Dresser	VIII	267–269
¶4***NOTE ON WINDY ARM SILVER BEARING VEINS,** McConnell	IX	49–53

* See Summaries, page 103
† " " 39
‡ " " 67
¶ " " 25
*1 " " 49
†1 " " 74
‡1 " " 83
¶1 " " 3
*2 " " 50
†2 " " 31
‡2 See Summaries, page 109
¶2 " " 108
*3 " " 68
†3 " " 80
‡3 " " 88
¶3 " " 36
*4 " " 91
†4 " " 124
‡4 " " 104
¶4 " " 110

	Vol.	Page
***NOTES ON THE YMIR MINE AND ITS MILL PRACTICE,**		
FOWLER	III	3-10
Discussion on, by:		
WOAKES, FOWLER, HARDMAN, HAY	III	169
Nottaway River, CHIBOUGAMAU, QUE.:		
Huronian formation on	VIII	366
Noumeaite, OR NOUMEITE.		
Analyses	IX	306, 307, 308
Nova Scotia:		
Coal:		
beneath neo-carboniferous	V	358–364
import duty on	VI	451
mining accidents, 1902	VI	448
address by FERGIE	VI	446 et seq.
production, 1900	V	564
1902	VI	445
Coke production, 1900	V	565
Geological similarities of iron-bearing regions to Lake Superior Districts	II	67
Geological surveys in	IX	95
Gold measures:		
compared with Bendigo, Australia	II	121
	IV	45
discovery and area	II	119
geology	II	120
thickness and extent of veins	II	128
Gold mining in:		
address by G. W. Stuart on	IV	44–48
history of	II	162
inactivity in, reasons for	II	164
production, 1901	V	568, 583
1902	VI	449
report of Geological Survey on	II	162
Graphite in	X	86
Iron ore production, 1900	V	565
and steel production, 1902	VI	449
Mineral production:		
1869–71	IX	95
1899	III	182, 189
1900	IV	293, 309
	V	564
1902	VI	453
Mining in:		
1899, review of	III	188, 189
1901, notes by BELL	V	582
laws of, notes by COSTE	VII	457
miners' wages	IV	45
Molybdenite occurrences	VI	49
Pyrite	II	163
Nova Scotia Steel & Coal Co., NEW GLASGOW, N.S.:		
Bounty paid to, 1900	IV	313
Coal cutting	VI	447
Coking plant, operations, 1900	IV	310, 311

---

* See Summaries, page 14

	Vol.	Page
Nova Scotia Steel & Coal Co., New Glasgow, N.S.—Con.:		
Description of steel works	IV	34–35
Drilling by, in Torbrook Dist., N.S.	IX	33
Furnace returns	II	60
Iron mines of	III	130
Iron ore imports, 1900	V	566
Labour	IV	35
North Sydney coal mine	IV	35, 61
Production, 1899	III	122, 188
	IV	35
1900	V	565
1901	V	582, 583
Wabana iron mines	IV	64–67
Nuggets:		
Silver, Algoma Dist., Ont.	IV	175
***NUMBER FOUR PIT, BRAYTON DOMAIN COLLIERIES, CUMBERLAND, ENGLAND.** Cowen	IX	402–412
No. 1 Concentrator, Slocan Dist., B.C.	VI	152
No. 1 mine, Rossland, B.C.:		
Notes by Kirby on ore deposits at	VII	48 et seq
No. 7 mine, Boundary Dist., B.C.:		
Note by Brock	V	376
No. 2 Nickle mine, Copper Cliff, Ont.:		
Notes on by Carter	VII	149
Nystrom, Erik	VII	267

O

Oak:		
for Charcoal	II	47
Oatey, Richard	X	368
Oaxaca, Mexico:		
Gold mining in	VIII	272
OBALSKI, J.:		
Discussions by, on:		
Magnetic Concentration	VII	278
The National Importance of Mining	V	154
Nickel Deposits of Norway	VII	409
Occurrences, Production and Uses of Mica	VII	304, 307
Some Laboratory Experiments in Making Steel from Iron in the Electric Furnace	IX	134
Some Mining Camps in the Lardeau Dist., B.C.	VII	112
Elected Councillor, C.M.I., 1898:	I	18
1905	VIII	34
Notes by, on:		
Quebec mining laws	X	19
Oil at Gaspe	II	209

* See Summaries, page 126

	Vol.	Page
OBALSKI, J.—Conr:		
Papers by:		
**On a Mineral Containing "Radium" in the Province of Quebec*	VII	245-246
†*Mining in Quebec Province, 1898*	II	62
‡*New Discoveries in Northern Quebec*	X	105-107
¶*A New Mining District in the North of Quebec*	VIII	363-366
‖*Notes on the Magnetic Iron Sand of the North Shore of the St. Lawrence*	IV	91-98
°*On the Probability of Finding Mines in Northern Quebec*	IX	218-220
***Rare Earths in Pegmatite Veins*	IX	72–73
Views on a Mining Bureau in Montreal	VI	483
Min. refs.	II	26
	VII	10, 13
	IX	18, 28
Obatogamau Lake, ABITIBI DIST., QUE.:		
Granite near	IX	20
Ober-Gruna mine, SAXONY:		
Drilling	II	174
Obsidian:		
Notes by HIXON	X	302
††*ON THE OCCURRENCE AND DEVELOPMENT OF CORUNDUM IN ONTARIO,* BAKER	VII	410–421
‡‡*OCCURRENCE OF DIAMONDS IN THE DRIFT OF SOME OF THE NORTHERN STATES, THE,* BELL	IX	124–127
¶¶*OCCURRENCE OF DIAMONDS IN SOUTH AFRICA, WITH THE METHOD OF THEIR EXTRACTION AS ADOPTED AT THE DE BEERS DIAMOND MINES,* ABRAHAMS	V	62–75
‖‖*OCCURRENCE OF FREE-MILLING GOLD VEINS IN BRITISH COLUMBIA, AN.* MERRITT, WM. HAMILTON	II	143
Ochre:		
Canadian production, 1901	V	572
Norfolk County, Ont.	IV	266
Quebec production, 1898	II	65
1899	III	187
1900	V	350
Three Rivers Dist., Que.	II	62
Ochre mineral claim, POPLAR CREEK DIST., B.C.	VII	103
O'Connor, D.:		
Discussion by:		
On Suggested Improvements to the Mining Laws in Canada	VII	470
Odde River, NORWAY.	VII	405
Officers of the Institute, *see* Canadian Mining Institute.		
Ogilvie, William	VI	214
Ogilvie, W. M.	VI	214, 223
	VII	279
Ogmore patent:		
Coke	IV	236

* See Summaries, page 81
† " " 7
‡ " " 131
¶ " " 108
‖ " " 25
° " " 110

** See Summaries, page 112
†† " " 87
‡‡ " " 115
¶¶ " " 40
‖‖ " " 12

	Vol.	Page
Ohio, U.S.A.:		
Depth of glacial grist	III	30
Discovery of diamonds in	III	152
	IX	124
Natural gas, analysis	VI	101
	X	79
Oilfields	III	74, 84, 86
	VI	101, 103
		116
	X	79
Oil, (Petroleum):		
Apcheron, Russia	III	87
Bounty on	X	80
Calorific value as compared with coal	VIII	59
in Cambrian rocks	III	82
Canadian production:		
1901	V	572
1902	VI	454
1906	X	12
in Carboniferous rocks	III	81
Cinnabar mines, California, presence in	VIII	181
Clinton formation	III	82
Corniferous formation	III	82
Costs	IV	172
in Devonian formation	III	81, 82
Fuel for assaying furnaces	V	288 et seq.
uses in Hawaiian Islands, paper by Williams	VIII	59–67
Gaspe Peninsula, boring for	II	64
Guelph formation	III	82
Horizons	II	81, 82
Spindle Top, Texas	VI	92
Hydrostatic theory	III	84
in Igneous rocks	VI	76 et seq.
Illuminating capacity of	VIII	300
Kent County, Ont., paper by Coste	X	77
Local distribution of	VI	117
Localization in productive areas	III	86, 87
Medina formation	III	78, 82
Mt. Zibio, Italy, springs	VI	86
Newfoundland	III	82
Notes on occurrences and industry by Miller	VI	43
Ohio, producing area	III	86
Ontario:		
geological horizons	VII	396
industry, 1905	IX	14
Notes by Miller	VII	175
Maidenstone Tp.	III	74
Medina formation	III	78
Occurrences, notes by Bell	VII	394
Gibson	VII	392
Miller	VII	387
price of	X	80
statistics:		
1900	IV	304
1901	V	581
1902	VI	464, 465
1893–1903	VII	392
1903	VII	427, 430

	Vol.	Page
Oil, (Petroleum)—Con.		
Ontario—Con.		
Western, geological formation	II	207–211
Origin	III	78
Mendelejeff's views	VI	123
notes by BELL, R.	VI	127 et seq.
paper by COSTE	VI	73–128
volcanic, proofs of	III	85–89
Oriskany formation	III	82
Pennsylvania	III	86
in Safety lamps	VI	201, 207
Rock pressure	III	83, 84
"Sands," definition of term	III	80
in Silurian rocks	III	82
Storing	VIII	60
Trenton formation	III	82
Ohio	II	209
West Virginia	III	81
Oil burners:		
Compressors, notes by SAUNDERS	V	162
Notes by WILLIAMS	VIII	61
Oil concentration, *see also* Concentration.		
Molybdenite	VI	54
	VII	164
Paper on, by HAMILTON	VII	185–191
Slocan Dist., B.C.	VII	201, 203
costs	VII	206
dry ores	VII	207
Oil furnaces:		
Assaying and melting, paper by BRENT	V	288–295
Oil "sands":		
Definition of term	III	81
	VI	110
Formation, Eastern North America	VI	109
Ontario, notes by COSTE	III	80 et seq.
Oil shales, *see also* Albertite.		
Lothians, Scotland	VI	77
Notes by CADELL	VI	117
Oil Springs, ONT.:		
Natural gas	III	68
Oil storage:		
Hawaiian Islands	VIII	60
Oil wells:		
Bothwell, Ont.	II	189
Coste No. 1	II	208
Gaspe, Que.	II	209
Goderich, Ont.	II	210
Oswego County, N.Y.	VI	97
Spindletop, Texas, depth of	VI	92
Tilbury, Ont.	X	77
Wallaceburg, Ont.	II	188
***OLD AND NEW IRON INDUSTRY COMPARED, THE.**		
BIRKINBINE	V	218–227
Old Bed iron ores, ADIRONDACKS:		
Treatment of	X	112

* See Summaries, page 47

	Vol.	Page
Old Castile, SPAIN:		
Iron ore	IV	196
Old Ironsides mine, PHOENIX, B.C., *see also* Ironsides mine.		
Timbering at, paper by DEPENCIER	V	424 et seq.
Old Mines, SYDNEY, N.S.:		
Coal	VI	446
Description	IV	61
Methods of working at	IV	61
THE OLD VALLEY GRAVELS OF THE KLONDIKE,		
MCCONNELL	III	124–127
Discussion on, by:		
COSTE, HARDMAN, LECKIE, R. G., GOODWIN, MCCONNELL, STEVENSON, BELL, PORTER, TYRRELL	III	209–217
Oldfield, F. W.	VII	206
Oldham Dist., HALIFAX CO., N.S.:		
Gold mining	X	426 et seq.
Oldman River, BELLY RIVER, ALTA.:		
Coal on	X	232
†***OLDHAM STERLING GOLD MINE, NOVA SCOTIA, THE.***		
BRENNAN	X	426–441
Olefiant gas:		
Value as fuel	IV	138
Oliphant, F. H.:		
Report by on Texas oilfields	VI	92
Olive mineral claim, SEINE RIVER DIST., ONT.	VI	332
Oliver Iron Mining Co., ELY, MICH., *see also* Pioneer Iron Mine	VII	356
Olivers Ferry, N. ELMSLEY TP., LANARK CO., ONT.:		
Graphite mill at	X	91
Olivine, *see also* Chrysolite.		
Douglas County, Ore., occurrence	IV	186
New Caledonia nickel deposits	VI	170
Occurrence in meteorites	VI	170
Platinum, relation to	VIII	202
Olivine-diabase:		
Howard mine, Suffield, Que.	V	84
Olizarine:		
Manufacture	V	145
Omineca District, B.C.:		
Gold mining	X	228
Mining conditions, notes by LEACH	X	228
Prospecting in, paper by MUSGRAVE	III	90–96
Routes to	III	90
Onaping Lake, ALGOMA DIST., ONT.:		
Jaspilyte	IV	280
Onondaga County, N.Y., U.S.A.:		
Gas pressure	VI	112
Oil wells	VI	97
Onondaga formation (SILURIAN):		
Essex County, Ont.	III	74
Gypsum in	VII	166
West Ontario	III	74
Tilbury oilfield, Ont.	X	82

* See Summaries, page 21
† " " 148

	Vol.	Page
Ontario:		
Arsenic manufacture	IV	122
Copper production, 1901	V	568
Corundum:		
BAKER, paper by	VII	410–424
Deposits, notes by MILLER	III	200–201
Mining and concentration in, paper by FAIRLIE	V	164–170
Diamond drilling by Government of	IX	389
Diamonds, probability of finding in	III	149–160
Gold:		
deposits in Eastern, paper by KNIGHT	VII	210–244
fields of Western, paper by BRENT	VI	327–335
industry, 1898	II	243
occurrences	II	105
production, 1901	II	568
Graphite in	X	86
Iron:		
deposits	VI	462
in Western, paper by HILLE	V	49–61
exploration, paper by WILLMOTT	VII	257–265
fields, paper by MILLER	IV	265–283
industry, 1898	II	59
1900, notes by BELL	IV	301 et seq.
production, 1900	V	565
Mine-mismanagement in, notes by BRENT	IV	174–179
Mine taxation in	X	13
Mineral lands, alienated, 1897–1902	VII	460
Mineral production:		
1869–1871	IX	95
1893–1903	VII	391
1899	III	182, 187
1900	IV	293, 300
		303 et seq.
	V	564
1901	V	581
1902	VI	454, 465
		467
1903, paper by GIBSON	VII	425–430
1905	IX	14
Notes by SMITH	X	2
Mineral rights on Indian reserves	II	242
waters	VIII	89
Mining industries of Eastern, paper by MILLER	V	233–255
industry of, paper by CARTER	VII	114–167
1901, notes by BELL	V	579
investments in	VII	440, 442
law, paper by Clark	III	110–117
legislation, 1900	IV	290
notes on, by COSTE	VII	453, 460
paper by CLARK	IX	113–114
Molybdenite occurrences	VI	49, 50
Museum, need of	VIII	68–73
Natural Gas in, paper by COSTE	III	68–89
notes by AMI	II	186–190
		208
Nickel industry	III	224–248
1905	IX	14
production, 1889–1897	III	234, 235
1900	V	528

	Vol.	Page
Ontario—Con.		
Petroleum	II	186, 207
		211
	III	68–69
	X	77–84
Pyrite deposits	X	118
Radio-active minerals	VII	254
Royalties on minerals in	X	340
Silver production, 1901	V	569
Undeveloped mineral resources of, paper by MILLER	VII	377–396
Water powers	III	139
Zinc	VII	374
Ontario Bureau of Mines:		
Mineral exhibit, Pan-American Exposition	V	252
Students employed by	VII	448
Ontario Corundum Co.	VII	413
Operations of, notes by CARTER	VII	160
Plant of	VII	415
Ontario Government:		
Diamond drilling by	IX	389
Prohibition of copper-nickel export by	III	226–248
Ontario Graphite Co., OTTAWA, ONT.	IV	303
	X	92
	V	254
Ontario Lead & Zinc Co., SUPERIOR, WIS., U.S.A.	VII	156
Ontario Mining Institute:		
Dissolution of	II	198
Organization of	VII	28
***THE ONTARIO MINING LAW,** CLARK	III	110–117
Ontario Natural Gas Company	III	68
Log of well	III	68
Ontario Rolling Mills Co.:		
Iron bar production	IV	313
Ontario Smelting Works, COPPER CLIFF, ONT.	V	579
	VII	149
O. P. mineral claim, BOUNDARY DIST., B.C.:		
Note by Brock	V	368
Open hearth furnace:		
Sydney, C.B.	X	373
Open hearth steel, *see also* Steel.		
Corrosion of	VIII	48
Ophir Ludi mineral claim, LARDEAU DIST., B.C.	VII	101
Ophir mineral claim, POPLAR CREEK DIST., B.C.	VII	103
Ophir mine, COMSTOCK LODE, NEVADA:		
Timbering	VI	129
Ophir mine, LAKE OF WOODS DIST., ONT.	II	241
Litigation respecting	II	242
Orange River Colony, S. AFRICA:		
Diamond mining in	V	62 et seq.
O-Ray iron claim, KITCHENER, B.C.	V	77
Orcanera iron mine, SPAIN:	IV	196
Ordovician:		
Huron-Erie Peninsula, Ont.	II	187
Montreal Island	VIII	86
Ouachita and Arbuckle Mts., Indian Territory, U.S.A.	VI	113

* See Summaries, page 20

	Vol.	Page
Ore bins:		
Knob-Hill-Ironsides mines, Phoenix, B.C.	v	428
LeRoi mine, Rossland, B.C.	v	315, 332, 460
Loading chute for, plan	v	426
Notes by GARDE	vi	305
Ore-crushing, *see also* Crushing:		
Before feeding to stamp mill	iv	194
Corundum	v	165
Costs, Northport smelter, Wash.	v	318, 336, 337
for Cyaniding	iv	190
Deloro mill, Ont.	iv	119
Helena Frisco mill, Idaho, U.S.A.	iv	256
Huntington mill	iv	190
Notes on by PORTER	iv	205–207
Republic, Wash.	v	276
Rolls for	iv	190
Stamp-mill, duty of	iv	190–195
Ore deposits:		
Asbestos, origin	v	351
Copper, paper by KEMP	x	251–256
Geological investigation, notes by HARDMAN	v	121 et seq.
Gold, concentration of in veins	ii	129
Graphite, notes by BRUMELL	x	87
Iron, magmatic differentiation	v	56
Magnetic surveying of	v	377
Metasomatic action	ii	80
Mica, notes by CORKILL	vii	296
Mineralization, result of expiring vulcanism	ii	84
Molybdenite	vii	164
Nickel:		
notes by CAMPBELL & KNIGHT	x	275
paper by DICKSON	ix	236 et seq.
Oxidation of	v	297, 298
Replacement	v	521
Pyrite, origin, paper by WILLMOTT	x	118
"Saddle reefs"	ii	122–128
Volcanic action, affecting	ii	83

British Columbia:		
Boundary District	v	173
notes by BROCK	v	368 et seq.
Knob Hill-Ironsides mine	v	425, 517
Mother Lode mine	v	515
Franklin Camp, paper by BROCK	x	170 et seq.
Kamloops Dist.	v	371
Kootenay, East		
Kimberley	v	513
North Star mine	v	512
St. Eugene mine	v	511
Kootenay, West	ii	74–80
notes by BROCK	iii	141–144
Lardeau Dist.	vii	109
notes by BROCK	vii	93
Rossland Dist.	v	520
	vi	130
notes by KIRBY	vii	52–59

	Vol.	Page
Ore deposits—Con.		
British Columbia—Con.		
Similkameen Dist., Copper Mt.	V	499
Slocan Dist.:		
notes by Fowler	VI	147
Slocan Star mine	V	509, 510
in southern	II	78
Texada Island, bornite	VIII	177
Marble Bay mine	X	248
Vancouver Island:		
copper	IX	42
notes by Brewer	VI	192
Labrador Peninsula:		
Nastapoka islands, iron	V	257 et seq.
Norway:		
Kristiana Dist., copper	V	371 et seq.
Ontario:		
Animikie range	VI	245–287
Atikokan, nickel	IX	294
Cobalt Dist.:		
paper by Bell	X	62–71
paper by Van Hise	X	45–53
Eastern:		
gold, notes by Knight	VII	210 et seq.
mica	V	244
Madoc Tp., pyrite	V	242
Mattawin range, iron	V	53
Mica	VII	162
Rainy River, gold	VI	333
Sudbury Dist.:		
nickel	V	235
		536 et seq.
	X	309, 312
		313
notes by Dickson	IX	236 et seq.
Silver	V	528 et seq.
South-eastern, iron	IV	268
Thunder Bay:		
Gold	II	88
silver	VII	140
Titaniferous magnetites	IV	269
Western:		
gold, notes by Brent	VI	329, 330
iron, notes by Hille	V	49 et seq.
pyrites	VII	158
Quebec:		
Eastern Townships, copper	V	82 et seq.
Spain:		
Somorrostro Dist., iron	IV	198
United States:		
Butte, Montana	V	296–301
Douglas Co., Oregon, nickel	IV	186
Goldfield, Nevada, gold	VIII	43

	Vol.	Page
Ore deposits—Con.		
Lake Superior:		
iron	IV	275
Keweenaw peninsula	X	399
Yerington, Nevada, copper	X	257–260
**ORE DEPOSITS OF THE BOUNDARY (CREEK) DISTRICT, B.C., THE,* BROCK	V	365–378
†*ORE DEPOSITS OF THE COBALT DISTRICT, ONT., THE,* VAN HISE	X	45–53
Discussion by, on: INGALL, HIXON, PARKS, COSTE, BELL, TYRRELL, BROCK	X	53–61
‡*ORE DEPOSITS OF COPPER MOUNTAIN, SIMILKAMEEN DISTRICT, B.C., THE,* SCOTT	V	493–502
¶*ORE DEPOSITS AND GEOLOGY OF THE SUDBURY DISTRICT, THE,* HIXON	IX	223–227
Discussion by, on: BARLOW, DICKSON, WALKER, HOPPER, ADAMS	IX	227–235
||*ORE DEPOSITS OF ROSSLAND, BRITISH COLUMBIA, THE,* KIRBY	VII	47–58
Discussion by, on: COSTE, BROCK, COLEMAN, THOMPSON, INGALL, MICKLE	VII	59–69
Ore dressing, *see also* Concentration, Milling, etc.		
Arsenopyrite, Deloro mine, Ont.	IV	117
Asbestos	V	355 et seq.
Belmont gold mine, Ont.	VII	241
Corundum	V	166, 169
Classifying before re-grinding	IV	190
Crushing:		
costs	V	318, 336 337
galena, Slocan Dist.	VI	153
gold ores	V	282
iron ore	VI	9, 11, 15 18
LeRoi mine, Rossland	V	331
Mother Lode mine, Boundary Dist., B.C.	V	215
nickel-copper ore, Copper Cliff, Ont.	V	544
Crushing and sizing, notes on by PORTER	IV	205–23
Diamond-bearing blue ground	V	64 et seq.
Helena Frisco mine, Idaho, U.S.A.	IV	256 et seq.
Laboratory teaching in	V	4
McGill University, notes on laboratory experiments	IX	153
Molybdenite	VI	52 et seq.
Republic, Wash., notes by CIRKEL	V	274–287
Screening, galena, Slocan Dist., B.C.	VI	156
Sizing:		
corundum	V	167, 168
LeRoi mine, Rossland	V	331
nickel-copper ore, Copper Cliff, Ont.	V	544

* See Summaries, page 53
† " " 127
‡ " " 56
¶ See Summaries, page 120
|| " " 74

	Vol.	Page
Ore dressing—Con.		
Slocan Dist., B.C., paper by CAVERS	VII	199–207
Sorting:		
Copper Cliff, Ont.	V	534
Mother Lode mine, Boundary Dist., B.C.	V	213
Slocan Dist., B.C.	VI	149, 154
costs	VII	205
Ore house:		
LeRoi mine, Rossland, B.C.	V	410
"Ore in sight":		
Definition of term, by Institution of Mining and Metallurgy	IX	283
Ore loading:		
Costs	V	336, 337
Ore pockets:		
LeRoi mine, Rossland, B.C.	V	328
Ore samplers:		
"Time samplers"	II	108
Ore sampling, *see also* Sampling.		
Paper by LEDOUX	II	108–118
Ore shutes:		
Mother Lode mine, Boundary Dist., B.C.	V	214
Ore sorting:		
LeRoi mine, Rossland, B.C.	V	468
costs	V	316, 318
Tables, speed of	V	342
Ore storage:		
Notes by MacDonald	V	342
Oregon, U.S.A.:		
Discovery of diamonds in	III	152
Nickel prospects, notes on by LEDOUX	IV	184–189
Nickel-silicates, analysis	IV	185
Oregon Tunnel nickel mine, DOUGLAS CO., ORE., U.S.A.	IV	187
Orford Copper Co.		
Nickel, produced by	III	224
	IV	184
	V	523
matte analysis	V	534
refining plant	V	548
process	III	225–245
notes by KOEHLER	V	192, 393–398
"Orford syphon-tap"	IX	59
Orford Tp., SHERBROOKE CO., QUE.:		
Nickel	III	224
ORIGIN OF DEPOSITS OF PYRITES, THE, WILLMOTT	X	118–128
Oriskany formation:		
Amherstburg, Ont.	III	74
Correlation with Sylvania sandstone	VII	173
Essex County, Ont.	III	75
Euphemia, Ont.	III	82
Oro Denora mine, BOUNDARY DIST., B.C.:		
Ore deposit	V	368

* See Summaries, page 132

	Vol.	Page
Oro Fino mill, FAIRVIEW, B.C.:		
Type of mortar in use at	II	36
Orthite, *see also* Allanite.		
Taché Tp., Que.	IX	73
"Orthoceras":		
Boisdale Hills, C.B.	VI	428
Orton, Prof. Edward:		
Analysis by of natural gas, Ohio and Indiana	VI	101
Quoted on fractured structure of strata in gas and oil fields	III	74
Report by, on:		
natural gas and petroleum	III	84
Ohio oilfields	VI	103, 117
shales	II	186
Views on:		
impermeability of strata in oil regions	VI	116
origin of petroleum	VI	97, 98, 100 119, 122
Ortuella, SPAIN, *see* Spain.		
Osann, Prof. A.:		
Quoted on graphite occurrence	X	89
Osborne Bay, VANCOUVER ISLAND, B.C.:		
Smelting works at	V	229
Osceola copper mine, MICH., U.S.A.:		
Production costs at	X	415
O'Shaugnessy, M. M.	VII	74
Osmiridium:		
Cariboo Dist., B.C.	X	423
Osmium:		
Note on by MILLER	VI	37
Oswego County, N.Y.:		
Oil-wells	VI	97
Otago, NEW ZEALAND, *see* New Zealand.		
Ottawa, Ont.:		
Asbestos occurrences near	V	355
Ottawa County, QUE.:		
Feldspar	III	187
Iron ores of	X	110
Mica:		
occurrences	IV	305
	VII	289, 290
production, 1899	III	187
Ottawa Carbide Company	III	139
Ottawa Gold Milling & Mining Co.:		
Reduction works	I	10
Ottawa River, ONT.:		
Graphite on	X	86
Water power	III	139
Otter Creek, ATLIN DIST., B.C.:		
Gold production, 1900-1901	V	32
Notes on by GWILLIM	V	30 et seq.
Ouachita Mts., BRUNSWICK DIST., ARK., U.S.A.:		
Bitumen deposits	VI	105, 113
Outremont, QUE.:		
Artesian wells at	VIII	94
Oven furnace:		
Deloro, Ont.	IV	150
Oxy-hydrogen blast:		
Platinum manufacture	VIII	193

	Vol.	Page
Oyster-Criterion mine, FISH RIVER, LARDEAU, B.C.:		
Mineralization at, notes by BROCK	VII	96
Oyster Harbour, VANCOUVER ISLAND, B.C.:		
Formation	VI	195
Ozocerite:		
Boryslaw, Galicia, Austria	VI	77, 108
Oxidation:		
Boundary Dist., B.C.	V	374 et seq.
Butte, Mont., effect of	V	297, 298
Loon Creek Dist., Idaho, zone of	IX	56
Problem of, in steel manufacture	X	388
Rossland Dist., B.C.	V	452
Slocan Star mine, Sandon, B.C.	V	509

P

Pacific Coal Co., Ltd., BANKHEAD, ALTA.:		
Anthracite breaker, paper by STOCKETT and WARDEN	IX	261–271
Report on colliery of, by HENRETTA	VIII	215–220
Pacinotti:		
Constructor of first dynamo	III	134
Packer Mt., CUSTER COUNTY, IDAHO, U.S.A.:		
Mining on	IX	54
Page, INDIAN TERRITORY, U.S.A.	VI	105
Page & Stearns:		
Iron on property of	IX	34
Paint Lake, MICHIPICOTEN, ONT.:		
Pyrite at	X	122
Paint Mt., CHIBOUGAMAU, QUE.:		
Gold on	IX	222
Minerals on	VIII	363
	IX	18
Nickeliferous pyrrhotite	IX	221
Quartz on	IX	18, 20
Palaeontology:		
Economic value of study of	VII	171
Palaeozoic:		
Frontenac Co., Ont.	VII	215
Goldfield, Nevada	VIII	40
"Oil sands" in	VI	109
Ottawa Co., Que.	VII	290
Rocky Mountain foothills	V	106
St. Lawrence Valley, Que.	VIII	86
Study of in Canada, notes by PARKS	VII	172
Texada Island, B.C.	X	243
Western Ontario	II	188
Windy Arm, Y.T.	IX	49
Palladium:		
Cariboo Dist.	X	423
Rambler mine, Wyoming	VIII	204
Sudbury Dist., Ont.	V	534
	VIII	211, 212
Palliser coalfield, ALTA.	X	231, 232

	Vol.	Page
Palmer, R. E.:		
Chief engineer, LeRoi mine	v	319
Palmer's Shaft, BRUCE MINES, ONT.	x	159
Pan-American Exposition, BUFFALO, U.S.A.:		
Ontario mineral exhibit	v	252
Panama:		
Asphalt deposits	vi	89
Panther Creek, RED DEER RIVER, ALTA.:		
Coal at	x	231, 232
Paraffine, *see* Oil, (Petroleum).		
Paraffine wax:		
Ontario production, 1903	vii	430
Pardee, Governor:		
Bill passed by, to discourage dishonest promoting	x	321
Parent, S. N.	ix	18
Paris, BRANT CO., ONT.:		
Gypsum mining near	vii	166
Paris Exhibition:		
Canadian minerals at, 1855	ix	93
"Paristone":		
Manufacture of in Ontario	vii	166
Parker, Edward W.:		
Report by, on asphaltum	vi	95
PARKS, DR. W. A.:		
Discussions by, on:		
The Cobalt Mining District	x	69, 71
The Geological Survey of Canada as an Educational Institution	vii	440, 446
The Ore Deposits of the Cobalt District, Ont.	x	55
Papers by, on:		
**The Need of a Provincial Museum in Ontario*	viii	68–73
†*The Study of Stratigraphy*	vii	168–174
Parks Lake, ALGOMA DIST., ONT.:		
Hematite	iv	281
PARLEE, NORMAN W.:		
‡*Rock Drilling and Blasting*	vi	376–389
Parrish, S. F.	vi	440
	vii	58
Parry Sound Dist., LAKE HURON, ONT.:		
Copper in	vii	146
	viii	181
Gold-copper ores in	vii	121
Iron mining in	vii	154
Silver mines at	vii	142
Parry Sound gold mine,:		
HARDMAN, note by on	viii	265
PARSONS, W. F. C.:		
¶*Prospecting for iron ore in the Torbrook District, Annapolis County, N.S.*	ix	31–34
Patriotic fund:		
Canadian Mining Institute's contribution to	iii	190
Patten, Tp., ALGOMA, ONT.:		
Rock movements in, notes by MILLS	vii	177–184

* See Summaries, page 94
† " " 78
‡ See Summaries, page 72
¶ " " 109

	Vol.	Page
Pay-roll:		
Considered in cost accounting	III	41, 42
Payne mine, Sandon, B.C.:		
Concentrator	VI	152
Note by Brock	II	80
Production, 1900	VII	370
Zinc concentrator at	VII	369, 372
Peace River, B.C. and Alta.:		
Belly River series in	VIII	221
PEACOCK, FRANCIS T.:		
**Rope Driven versus Direct Driven Colliery Ventilation Fans*	IV	107–112
Peat:		
Canadian, notes by Goodwin on Utilization of	V	148
Fuel for blast furnaces	II	224
	IX	328
Ontario:		
deposits, notes by Miller	VII	388
manufacture	VII	393
statistics, 1903	VII	429, 430
Organic remains in	VI	120
Rocky Mts., deposition of	VII	501
Source of coal	VIII	236
Utilization of, in producer gas plant	IX	327
Peat Development Syndicate, Toronto, Ont.:		
Exhibit Buffalo Exhibition	V	254
Pegmatite:		
Appalachian Mts.	VII	287
Himalayan Mts.	VII	286
Lardeau Dist., B.C.	VII	90
Methuen Tp., Ont., unusual type of	VII	307
Origin of, notes by Knight	VII	234
Rare earths in, paper by Obalski	IX	72–73
Pelatin-Clerici process:		
Cirkel, notes by	V	274
Republic, Wash.	V	275
Pembina River, Alta.:		
Coal on	X	235, 236
Pembina, Manitoba:		
Coal seams	VIII	242
Natural cement	V	578
Pembroke Dist., Ont.:		
Iron	II	225
Penabic vein, Quincy Copper Mine, Mich., U.S.A.	X	401
Penfield, Prof.	VIII	204
Penhale, John J.:		
Elected Councillor C.M.I., 1898	I	18
Min. ref.	IX	27
Pennfield, Charlotte Co., N.B.:		
Molybdenite	VI	49
Pennsylvania, U. S. A.:		
Coal mining methods	IV	128
Coalfields, mining law respecting barrier pillars	IX	381
Coke, quality of	IV	235
Oilfields	III	86
	VI	111, 115

* See Summaries, page 26

	Vol.	Page
Pense Tp., NIPISSING, ONT.:		
Cobalt bloom and smaltite in	X	70
Conglomerate in	X	70
Diabase in	X	69
Pentlandite:		
Constituents of	X	275
Coppper Cliff mine, Sudbury Dist., Ont.	V	534
Sohland, Germany, nickel deposits	IX	260
Sudbury Dist., Ont.	V	235
	X	275
Peridotite (DUNITE):		
Analysis	IX	313
Canada, occurrences	III	196
Diamonds in, Kimberley, South Africa	III	195
Douglas County, Oregon	IV	186
Muskoka Dist., Ont.	IX	126
New Caledonia	VI	169
Platinum in	VIII	198, 200
Ural Mts.	VIII	201
Webster, N. Carolina	IX	304, 310
		311, 313
		314
Perkin, W. H.	VI	33
Perle de Koa nickel deposit, NEW CALEDONIA	VI	175
Perm, RUSSIA:		
Platinum deposits	VIII	196
Permian strata:		
Pictou County, N.S.	V	358 et seq.
Perth, ONT.:		
Corundum near	VII	417
Graphite mining near	VII	161
Peru:		
Huancavelica cinnabar mine	II	16
Peru-Bolivia-Chili:		
Gold production, 1801-1900	VI	25
Peterborough Co., ONT.:		
Allanite	VII	254
Corundum belt	III	200
Galena ores	VII	143
Geology and gold deposits, paper by KNIGHT	VII	210–244
Gold mining in	IV	303
Mica occurrences	VII	289, 304
Peters, Dr. E. D.:		
Canadian Copper Co's. smelter built by	VII	498
Peterson Lake, COBALT DIST., ONT.:		
Silver ores at, notes by MILLER	X	57
Petitcodiac, WESTMORELAND CO., N.B.:		
Graphite from	X	92
Petitiskapan Lake, HAMILTON RIVER, LAB.:		
Anthraxolite	VII	253
Petrographical determination:		
Iron ore, prior to concentration, advisability	VI	9 et seq.
Petrography:		
Amphibolite, Eastern Tps., Que.	V	346
Andesite, Copper Mt., Similkameen Dist., B.C.	V	494
Augite-diorite, Rossland Dist., B.C.	V	448
Augite-porphyrite, Texada Island, B.C.	VIII	175
Chlorite-mica schist, Belmont, Ont.	VII	222
Diabase-porphyrite, Texada Island, B.C.	VIII	175

	Vol.	Page
Petrography—Con.		
Gabbro, Belmont gold mine, Ont.	VII	216
St. Stephen, N.B.	IX	242
Gneiss, Nipissing, Ont.	VI	75
Granite-porphyry, Eastern Tps., Que.	V	82
Greenstone, Sudbury Dist., Ont.	V	529 et seq.
Monzonite, Rossland Dist., B.C.	II	74
Museum collections representing	VIII	69
Porphyry, Copper Mt., Similkameen Dist., B.C.	V	496
Pyroxene, Rossland, B.C.	VII	49
Texada Island, B.C.	VIII	175
Marble Bay mine	X	247
Quartz-porphyry, Eastern Tps., Que.	V	82
Petroleum, *see* Oil.		
Petroleum refinery:		
Gaspe, Que.	III	187
Petrolia, ONT.:		
Natural gas	III	68
Petrowsk iron works, SIBERIA	VI	30
Pew & Weart:		
Graphite mining by	X	90, 91
Peyton, I. N.:		
Sale of LeRoi mine by	V	312
Philadelphia Commercial Museum:		
Description of	VI	319
Philipsburg, QUE.:		
Limestone, notes by DONALD	V	47
Phlogopite, *see also* MICA:		
CORKILL, notes by, on	VII	284
Lacey mine, Ont., analysis	VII	295
Occurrences	VI	45
Ontario and Quebec	V	244
Phoenix, BOUNDARY DIST., B.C.:		
Copper at	V	172, 174
Ores, character and grade	V	174
Phoenix process	V	14
Phosphate, *see also* Apatite.		
Quebec industry, 1898	II	64
1899	III	188
Shipments from Tennessee to Buckingham, Que.	IV	75
Phosphorite:		
Florida, U.S.A.	VI	42
Phosphorus:		
Determination of	X	448
Electrical manufacture of	III	139
Elimination of, in iron ores	II	218
	VI	12
	X	131
in Peat	II	224
in Steel:		
effect of	V	38
removal of	X	395
Tests for in pig iron	VI	292
Phyllite:		
Ferguson, Lardeau Dist., B.C.	VII	98

	Vol.	Page
Pic River, LAKE SUPERIOR, ONT.:		
Iron ore in	IV	281
Picking table:		
Coal	IV	166
Picrolite, *see also* Serpentine.		
Eastern Tps., Que	V	346
Pictou, PICTOU CO., N.S.:		
Copper reduction works at	IV	311
Pictou County, N.S.:		
Coal mining, 1901	V	582
1902	VI	445
notes by FERGIE	VI	447
Collieries	IV	34
Permian strata, possible occurrence of coal beneath, paper by AMI	V	358–364
Productive coal measures of	V	359
Pictou formation:		
Classed as Permian	V	361
Pieds des Monts Lac, CHARLEVOIX CO., QUE.:		
Cleveite at	VII	251
	IX	72
Pieds des Monts mica mine, near MURRAY BAY, QUE.	IX	72
Pierce, G. H.:		
Geological investigations, Eastern Tps., Que	V	82
Pieter lamp:		
for Testing gas in coal mines	VI	203
Pig iron, *see also* Iron:		
Analyses of	VI	290, 291
	X	373, 453
Bounty on, resolution of Institute respecting	IX	25
British Columbia, estimated cost of producing	V	79
price, Pacific Coast	V	80
Canadian:		
bounty paid on, 1900	IV	312
U. S. import duty on	IV	91
Charcoal consumption, per ton of	II	47
Electric smelting of	VIII	138, 142
	IX	132
	X	131
Exports, 1901	V	566
Production:		
Canada, 1900–1901	VI	6
1902	VI	454, 455
1906	X	12
and United States compared	VI	67, 68
Nova Scotia, 1901	V	583
1902	VI	448, 453
Nova Scotia Steel Co., 1900	IV	311

	Vol.	Page
Pig iron—Con :		
Production—Con.:		
Ontario: 1898-1900	IV	302, 304
1901	V	581
1902	VI	454, 464
1903	VII	391, 425
		429
1905	IX	14
Quebec, 1900	IV	305
United States, 1901	V	223
	VI	6
United States exports, 1898	II	57
Pigments, *see also* Mineral Pigments.		
Minerals used for making in Ontario	VII	385
White lead, manufacture of	VIII	246
Pike Lake mica mine, near MICAVILLE, ONT.:		
Notes by CARTER	VII	163
Pillar and stall system:		
Modification of	V	109
Pillars, (COAL):		
Pulling	IV	127
Size of	II	18
Pilley Island, NOTRE DAME BAY, NFLD.:		
Pyrite analysis	VI	406
deposit	VI	391
Pilot Bay concentrator, AINSWORTH, B.C.	VI	152
Pimelite:		
Analysis	IX	306–308
Pincher Creek, OLDMAN RIVER, ALTA.:		
Coal on	X	234
Pinckney, Captain C. C.	IX	305
Pine:		
Boundary Dist., B.C.	V	426
Sudbury Dist., Ont.	VII	495
White and yellow for charcoal	II	47
Pine Creek, ATLIN DIST., B.C.:		
Cross section	V	25
Gold production, 1900-1901	V	32
GWILLIM, notes on, by	V	21
Placer mining	III	99
Prospecting near	III	97
Pine Portage mine, LAKE OF THE WOODS R. R. DIST., ONT.:		
Description	II	239, 240
Pine Ridge, WEST KOOTENAY, B.C.:		
Formation at	II	77
Pinto River, S. AMERICA:		
Platinum from	VIII	192
PIONEER IRON MINE, ELY, MINN., THE, CARLYLE	VII	335–367
Discussion on, by:		
LECKIE, R. G., PORTER	VII	367
†***PIONEER WORK IN THE CROW'S NEST COAL AREA***		
BLAKEMORE	IV	230–243
Pipes (WROUGHT IRON AND STEEL):		
Bursting tests on	VIII	53
SPELLER, paper by, on	VIII	46–58

* See Summaries, page 84

† " " 34

	Vol.	Page
Pipe-line:		
Belmont mine, Ont.	VI	236 et seq.
Hawaiian Islands, sugar plantation	VII	72
Pitchblende:		
Joachimsthal, Bohemia	VI	44
Pitkaranta, FINLAND:		
Iron ore concentration	VI	19
	X	270
Pittsburg, PA., U.S.A.:		
Oil formation	VI	111
Placer gold, *see also* Gold, Gold-bearing Sands, Gold Mines, etc.		
Atlin Dist., B.C., notes on	III	98–99
origin of	V	32
Australia, discovery of	VI	26
Bridge River Dist., B.C., production to 1890	III	21
British Columbia production, 1901	V	572
Cache Creek series	V	22
Chaudière Dist., Que	II	212
Nova Scotia	II	162, 165
Ontario deposits	VII	117
Vancouver Island, B.C., notes by BREWER	VI	189
Vermilion River, Sudbury Dist., Ont.	V	238
Yukon, values	III	212
Placer mining:		
British Columbia conditions, 1900	IV	293
Atlin Dist., conditions	III	206
methods	III	99
size of claims	III	205
Omineca Div.	X	228
Yukon, methods	V	575
size of claims	IX	118–119
Placer mining claims:		
Regulations respecting, in Canada	VII	451 et seq.
Plan(s), *see also* Diagrams and Maps.		
Acid chamber, sulphuric acid manufacture	VI	397
Belmont mine, Ont., air-compressor plant	VI	240
Calcining furnace	VI	308
Centre Star mine, Rossland, B.C.:		
skip	V	464
stations	V	483
timbering	V	464
Deloro mine, Ont., air-lift	V	268, 272
Emma mine, Boundary Dist., B.C.	X	192 (opp)
Gay Lussac tower, sulphuric acid mfg.	VI	399
Glover tower, sulphuric acid mfg.	VI	395
Irrigation system, Hawaiian Islands	VII	74
Knob Hill mine, Phoenix, B.C., hoist	V	444
LeRoi mine, Rossland, B.C.	VII	60
Mine bulkhead	VII	83, 84
Mother Lode mine, Boundary Dist., B.C.:		
quarries	VII	42
stopes	V	214

	Vol.	Page
Plan(s)—Con.:		
North Brookfield, N.S., mill	VII	309
Oil furnace	V	293–295
Old Ironsides mine, Phoenix, B.C.:		
timbering	V	424 et seq.
underground station	V	443
Pioneer iron mine, Ely, Minn.	VII	338–346
		349, 353
Pyrite burner	VI	401
Rossland, B.C., square-set timbering	VI	136
Sydney, C.B., coking plant	IV	12
War Eagle mine, Rossland, B.C.	VII	64
"Platina del Pinto"	VIII	193
Platinum:		
Cariboo Dist.	X	423
Distribution, other than placers, paper by DICKSON	VIII	20
		192–210
Migration of, in solution	VIII	201, 202
Norway, occurrence	VIII	209
Occurrences, uses and price, notes on by MILLER	VI	36
Ontario, occurrences	VII	165, 381
Placers	VIII	194
Price of	VIII	195
Quebec, discovery of	VIII	211
Statistics:		
British Columbia, to 1906	X	185
Canadian, 1902	VI	455
World's production	VIII	194
Sudbury Dist., Ont.	V	534
	VII	499
Vessels for assaying, substances injurious to	V	43
Platinum sponge	VIII	193
Plattsburg furnace:		
Utilizing saw mill waste in iron making	II	50
Pleistocene:		
Montreal Island, Que	VIII	86
Pliny:		
Bilbao iron mines, Spain, ref. to	IV	196
Plumbago, *see* Graphite.		
Plummer, William	X	152
PLUNKETT, T. H.:		
Rate of Solution of Gold in Potassium Cyanide	VII	192–193
Plutonic rocks:		
Carbon and hydrocarbons in	VI	74
Pneumatic tools	V	162
Point Mamainse, MICHIPICOTEN ISLAND, ONT.:		
Native copper ores at	VII	147
	X	400
Pointe au Chêne, ARGENTEUIL CO., QUE.:		
Graphite at	X	90
Polley's Lake, QUESNELLE MIN. DIV., B.C.	X	420
Pollock, Sir Frederick	IX	113
Polson boiler	IV	172
Polson engine	IV	171, 238
Polson's Lake, ANTIGONISH COUNTY, N.S.:		
Copper	IV	311

* See Summaries, page 79

	Vol.	Page
Polydymite:		
Sudbury Dist., Ont.	v	534
Pontgiband, AUVERGNE, FRANCE.		
Relation of dykes to ore bodies	ii	84
Pontiac County, QUE.:		
Iron ores of	x	110
Nickel	ii	63
Pool Creek, LARDEAU DIST., B.C.	vii	93
Poole, Henry, S.:		
Cape Breton coal measures	iv	23
Elected Councillor, C.M.I., 1898	i	18
Pooley Canon, CONRAD, Y.T.	x	213
Poorman gold mine, NELSON, B.C.:		
Model of	vi	440
Pope, F. J.:		
Tests by, on titaniferous ores	iv	270
Pope, Rufus H.:		
On mining business in Canada	iv	80
Poplar:		
For charcoal	ii	46
Poplar Creek Dist., LARDEAU DIV., B.C.:		
Geology and ores of, notes on, by BROCK	vii	101
Ore deposits of	vii	93
***POPLAR CREEK AND OTHER CAMPS OF THE LARDEAU DISTRICT,** BROCK	vii	87–111
Discussion on, by: MILLER, COLEMAN, INGALL, BROCK, OBALSKI, MICKLE	vii	111–113
Poplar River, MILK RIVER, SASK.:		
Coal on	x	237
Population:		
British Columbia, 1901	vi	360, 363
New Caledonia	vi	179
Porcupine Creek, LARDEAU DIST., B.C.:		
Geological section of	vii	94
Porcupine silver mine, THUNDER BAY, ONT.	vii	141
Porphyrite:		
Copper Mt., Similkameen Dist., B.C.	v	494
Rossland, B.C.	v	449 et seq.
	v	520
Telkwa River, B.C.	x	221, 225
Windy Arm, Y.T.	ix	50
"Porphyrite group":		
Skeena River, B.C.	x	220
Porphyritic diabase:		
Mesaba iron range	vi	251
Porphyry:		
Auriferous, Valkyr Mt., Arrow Lake, B.C.	v	378
Boundary District, B.C.	v	172, 370
Conrad, Y. T.	x	211
Copper Mt., Similkameen Dist., B.C.	v	496
Gilbert River, Que.	viii	259
Porphyry-andesites:		
Ascot-Sutton, Que.	viii	260
Port Arthur, ONT.:		
Animikie formation	vi	247, 249

* See Summaries, page 76

	Vol.	Page
Port au Port, NFLD.:		
Pyrite, analysis	VI	406
Port Colborne, HUMBERSTONE TP., WELLAND CO., ONT.:		
Natural gas	III	68, 69
Port Elmsley, N. ELMSLEY TP., LANARK CO., ONT.:		
Graphite milling at	X	91, 92
Port Henry iron mines, ADIRONDACKS, NEW YORK, U.S.A.	VI	13
Magnetic separation at	X	111
Port Hood Coal Co., PORT HOOD, N.S.:		
Colliery opened by	IV	310
	V	582
Production, 1901	V	583
Port Morien, CAPE BRETON CO., N.S.:		
Collieries at	IV	310
Map of harbour	IV	131
Shipping coal at	IV	131 et seq.
Port Simpson, B.C.:		
Anthracite occurrence	VIII	240
Coal measures near	VII	424
Portage formation:		
Western Ontario	II	185
		189–190
Portage Island, CHIBOUGAMAU, QUE.:		
Copper on	X	105
Portage Lake, LAKE SUPERIOR, MICH., U.S.A.	X	400
PORTER, DR. J. BONSALL:		
Discussions by, on:		
By-law amendments, 1907	X	13
The Chlorination of Gold Ore of the North Brookfield mine, N.S.	VII	317, 318
The Dry Ores of the Slocan	VII	207
Magnetic Separation	VII	280
The National Importance of Mining	V	593
The Pioneer Iron Mine, Minn.	VII	367
The Relative Attraction of Minerals for Residuum Oil	VII	188, 190
Solution of Gold in Potassium Cyanide	VII	196, 197
Some Laboratory Experiments in Making Steel from Iron in the Electric Furnace	IX	135
The Status of the Mining Profession	X	331, 337
		338
The Utilization of Poor Coals and Slack	IX	328 et seq.
Elected Councillor, 1906	IX	27
Vice-President, 1907	X	17
Notes by, on:		
standardization	X	18
students' contributions to Institute Transactions.	VII	318
Papers by:		
**The Education of Mining and Metallurgical Engineers*	IX	143–160
Discussion on, by: DOUGLAS, HIXON, DARU	IX	160–167
†*Notes on Crushing and Sizing in the Ore-Dressing Laboratories of McGill University*	IV	205–223

* See Summaries, page 116
† " " 33

	Vol.	Page
PORTER, DR. J. BONSALL—Con.:		
Papers by—Con.:		
***Notes on some Work Recently Done in the Mining Laboratories of McGill University**	v	3–9
Vote of thanks to	vi	481
	ix	1, 27
Minor ref.	vi	478
	vii	279
	viii	10, 23, 36
	ix	23, 25
	x	5, 326
Portland Canal, B.C.:		
Copper occurrences at	x	200, 207
Portland cement, *see also* Cement.		
Building operations with, notes by MORRISON	vii	431
Limestones suitable for manufacture of	iv	154
Production:		
British Columbia, 1906	x	186
Canadian, 1906	x	12
Ontario, 1893-1903	vii	392
1902, notes by GIBSON	vi	464, 466
1903	vii	428, 430
Standard specifications for	viii	102
Portland mine, ROSSLAND, B.C.:		
Production, 1894-1904	vii	47
Porto Rico mine, BARRETT CREEK, NELSON DIST., B.C.,	iii	3
Posepny, Prof. Franz:		
Quoted on occurrence of magnetite	vi	192
Min. ref.	v	297, 298
†***ON THE POSSIBLE OCCURRENCE OF A COAL AREA BENEATH THE NEO-CARBONIFEROUS OR PERMIAN STRATA OF PICTOU COUNTY, NOVA SCOTIA,*** AMI	v	358–364
Potardiere, M. de La	ix	4
Potassium bichromate, *see* Bichromate.		
Potassium chloride:		
Electrolysis of	iii	136
Potassium cyanide:		
Gold solubility in	vii	193
Potassium hydrogen sulphate:		
Flux	v	43
Potsdam formation:		
Oil and gas in	vi	112
Ottawa Co., Que.	vii	290
Pottery:		
Molybdenum, in manufacture	vi	64
Ontario production, 1902	vi	464
1903	vii	430
Powder magazine:		
LeRoi mine, Rossland	v	338
Power, *see also* Water Power:		
Belmont gold mine, Ont.	vi	233
how Chargeable in mine accounting	iii	47, 64
Coal Creek Colliery, B.C.	iv	167

* See Summaries, page 36
† " " 52

	Vol.	Page
Power—Con.		
Compressed air:		
losses	V	158
THOMPSON, paper by, on	VI	180–187
Electric, Rainy River Dist.	II	166, 167
smelting, Sault Ste. Marie	VIII	138
Emma mine, Boundary Dist., B.C.	X	194
Gas-producer, notes on by DOWLING	IX	321 et seq.
Greenwood smelter	IX	358
LeRoi mine, Rossland	V	332, 406
Long distance transmission	II	167
Mother Lode mine, Boundary Dist., B.C.	VII	44
Norway, cost of	VII	407
Nova Scotia gold mines	IV	45, 46
Pumping	III	147
Roasting furnace	VII	487
Shawenegan, Que., price of	III	139
Ventilating fans	IV	111
Water compared with steam for generating electricity	III	137
Water gas, notes by SJOSTEDT	VIII	299
Power companies:		
Shawenegan, Que.	III	139
***POWER DRILLS,** HANSEN	V	484–492
Power house:		
Belmont mine, Ont.	VI	237
Pratt, Joseph Hyde:		
Quoted on:		
Ceylon graphite	X	87
Geology of Webster, N. Carolina	IX	311
Graphite consumption	X	96
industry of United States	X	100
Pre-Cambrian:		
Eastern Tps., Que.	V	85
	VII	397
Pre-carboniferous coal, *see* Anthraxolite.		
Precious stones, *see also various names of*		
Diamonds:		
derivation	III	154, 156, 157, 195, 196
drilling with	V	454
North America, paper by BELL	IX	124–127
Ontario, possibility of finding	VII	386
paper by BLUE	III	149–160 195–7
South Africa, paper by ABRAHAMS	V	62–75
Ontario	III	150
	VII	386
Royalty on, New Brunswick and Nova Scotia	VII	456, 458
Precipitating tanks:		
Republic reduction works, Wash.	V	285
Precipitation:		
in Bromo-cyanide process	IV	143, 148
Carbonate of lime and magnesia	VII	505
Cyanide of gold solution	V	285
of Water impurities	VII	506
Zinc dust consumption	V	285

* See Summaries, page 56

	Vol.	Page
Premier mine, SLOCAN DIST., B.C.:		
Vein	v	12
Pressure:		
Artesian water	iii	84
Compressed air	v	158, 162
Natural gas	iii	83, 84
	vi	112
Oil and gas wells, notes by COSTE	vi	97–99
Volcanic dislocations due to	vi	102
PRESTON, JOHN:		
***Test of a Two Stage Compressor**	ii	130
Prevost, Hon. John	ix	5, 24
Prince of Wales iron mine, NEGAUNEE, MICH., U.S.A.:		
Notes by ATKINSON	vii	319
Prince of Wales Island, ALASKA:		
Chalcopyrite	ix	42
Pyrrhotite	ix	48
Princeton, SIMILKAMEEN DIST., B.C.:		
Coal analysis	vi	227
Prince William Sound, ALASKA:		
Copper on	ix	45
	x	199, 207
†***ON THE PROBABILITY OF FINDING MINES IN NORTHERN QUEBEC,*** OBALSKI	ix	218–220
Producer gas, *see also* Gas Producer.		
Dellwik-Fleisher system	viii	291
Loomis-Pettibone generator	v	178
from Sawdust	ii	47
	ix	328
SJOSTEDT, notes on by	viii	291
Producer gas plant:		
Brandon, Manitoba	ix	324
Capabilities of	ix	326
Producer gas tests:		
U.S. Geological Survey	ix	332 et seq.
‡***PRODUCTION OF COPPER IN THE BOUNDARY DISTRICT, B.C., THE,*** LEDOUX	v	171–177
"Productus":		
Boisdale Hills, B.C.	vi	416, 426
¶***PROGRESS IN MAGNETIC CONCENTRATION OF IRON ORE,*** WELLS	vi	6–20
Prospecting:		
British Columbia, notes by KIRBY	vi	356
Chibougamau Dist., Que., opportunities for	ix	20
Cobalt Dist., notes by PARKS	x	69
for Diamonds	iii	151, 195
Dykes as guides to	ii	84
FORREST, notes by, on	vi	1
Geological considerations favourable to	v	376 et seq.
Government aids to	v	131, 136
Lardeau Dist., B.C., opportunities for	vii	110, 112
Ontario, in Indian reserves	iii	113
in unsurveyed territory	iii	113

* See Summaries, page 11
† " " 119
‡ See Summaries, page 44
¶ " " 58

	Vol.	Page
Prospecting—Con.:		
Quebec, for gold	II	120
northern, regulations for	IX	220
Rocky Mts., notes by MACDONALD	VI	343
Similkameen Dist., B.C., notes by SCOTT	V	501
Slocan, B.C.	II	80
Prospecting dredge:		
Paper by ROBINSON describing	VI	214–223
***PROSPECTING DRILLS,** DICKSON	IX	387–395
†***PROSPECTING FOR IRON ORE IN NEWFOUNDLAND AND CAPE BRETON,** MEISSNER	II	66
‡***PROSPECTING FOR IRON ORE IN THE TORBROOK IRON DISTRICT, ANNAPOLIS COUNTY, NOVA SCOTIA,** PARSONS	IX	31–34
¶***PROSPECTING TRIP IN NORTHERN OMINECA, B.C., A,** MUSGRAVE	III	90–96
||***PROSPECTING IN WESTERN CANADA,** CAIRNES	VIII	302–315
Discussion by COSTE	VIII	315
Prospectors:		
Equipment of	V	602
	VIII	305
Free grant to discoverers, in Ontario	III	115
Hints to	III	143
Tribute to	III	198, 199
Prospectors' license:		
New Brunswick	VII	456
Ontario	VII	454
Prospects:		
Effective development of	III	142
Superficial development of	III	199
Prospectus:		
Legal requirements concerning	IV	249
Protector safety lamp	IX	404
"Proterobase:"		
Sohland, Germany	IX	254
"Protogine":		
Atikokan, Ont	IX	290
Granite, so termed by HILLE	VIII	184
"Protosalvinia Huroneusis"	II	187, 189
Illustration	II	191
Prousite:		
West Kootenay	II	76
Prout, Frank	X	152
Provincial Mining Association of British Columbia:		
Address by HOBSON	VI	324
Memorial by to Government	VI	356, 363
Resolution by, on mine taxation	VII	459
Provincial Mining Bureaus, *see* Mining Bureaus.		
Provincial Natural Gas & Fuel Co. of Ontario	III	69, 75
"Prussian blue":		
Test in lixiviation practice	IV	147
Publications of Institute, *see also* Canadian Mining Institute	III	174
Notes by BROWN on re-publishing	VII	445
Pueblo copper claim, WHITEHORSE, Y.T.:		
CAIRNES, notes by	X	215
Development of	X	197

* See Summaries, page 126
† " " 7
‡ " " 109
¶ See Summaries, page 19
|| " " 166

	Vol.	Page
Puget Sound Iron Company	x	245
Pulleys:		
Haulage	v	39
Pulp:		
Current in amalgamating pans	iv	193
Tilghman process of making	vii	488
Pumice:		
Notes by HIXON	x	302
Pumping:		
Brayton Domain colliery, England	ix	404
Centre Star mine, Rossland, B.C.	v	466
Costs of	vii	81
in Drilling operations	v	454
Harris system, paper by KIRKEGAARD	v	265–273
Hawaiian Islands, irrigation system	vii	78
LeRoi mine, Rossland	v	330, 339, 422
with Petroleum fuel, statistics	viii	62
Pioneer iron mine, Minn.	vii	351
Regent iron mines, Mich.	vii	330
Susquehanna Coal Co., Pa.	ix	386
Pumps:		
Air brake	v	162
Centrifugal, for dredging	v	88
Cornish	iii	147
Electrical	iii	147
Glycerine as prevention to freezing	iii	197
Hot water, paper by HARDIE	vii	505–530
Jeansville	ix	386
Knowles fly-wheel	iii	128
LeRoi mine, Rossland	v	338
MORGAN, paper by	iii	145–148
Mother Lode mine, Boundary Dist., B.C.	ix	347
Northey	iii	128
Pennsylvania coal mines	iii	198
Rotary, advantages of	iii	129, 197
compared with direct acting straight line	iii	128, 129
Rubber cushions for valves	iii	146
Sinker	iii	145
Size in relation to service required	iii	146
Tangys compressed air	ix	404
Tripley, Coal Creek colliery, B.C.	iv	166, 239
Types of for irrigating works	vii	79
Punta Arenas, STRAITS OF MAGELLAN:		
Coal	vi	46
Purcell mountains, E. KOOTENAY, B.C.:		
Geology	v	507
"Purple Ore":		
Notes by MEISSNER	vi	406
Putz, Steinmetz & Egan copper claim, KNIGHTS' ISLAND, ALASKA	x	200
Puy de la Poix, AUVERGNE, FRANCE:		
Bitumen spring	vi	86
Pyrargyrite:		
West Kootenay, B.C.	ii	76
Yukon, Conrad	x	211
Windy Arm	ix	51

	Vol.	Page
Pyrite:		
Associated with graphite	VI	76
Attraction of, for oil	VII	187, 188
Canadian resources, notes by GOODWIN	V	148
in Concentration of iron ore, effect of	VI	9
Constituents of	X	275
Crushing	IV	208, 210
		222
Origin of	II	84
	VII	56, 59
	X	118–128
Price	V	236
Replacing augite	V	521
Residues, treatment of	X	269
in Sulphuric acid manufacture	IV	124
	VI	390
British Columbia:		
Boundary District	V	368, 517
King Solomon mine	V	375
Mother Lode mine	V	515
Kootenay, West	II	76
Lardeau Dist.:		
Fish River	VII	96, 97, 98
Poplar Creek	VII	105, 106
Rossland Dist.	V	452
Iron Mask mine	V	521
Texada Island	X	245
Canada:		
Statistics, 1902	VI	455
Nova Scotia:		
Boisdale Hills	VI	414, 424
Montague mine	II	163
Ontario:		
Industry, notes by CARTER	VII	157–159
MILLER	V	242
Madoc Tp.	V	242
Nipissing Dist.	IV	276, 277
Occurrences, notes by MILLER	VII	386
Statistics, 1902	VI	464
1903	VII	392, 426
		430
Sudbury Dist., North Nickel range	X	277
Quebec:		
Ascot	VII	398
Capelton	III	187
Chibougamau	VIII	363
Eustis	IV	308
Production, 1899	III	187
United States:		
Goldfield, Nevada	VIII	41
Yukon:		
Conrad	X	211
Windy Arm	IX	51

	Vol.	Page
Pyrites burner:		
Plan of	VI	401
Pyritic smelting:		
Highland Boy, Utah	VI	308
"Pyritic type of ore deposit:"		
Boundary Dist., B.C.	V	368, 371
Franklin camp, B.C.	X	172
Pyroligneous acid:		
Bye-product of charcoal	II	51
Pyrolusite:		
Note by MILLER	VI	40
Pyroxene:		
Marble Bay mine, Texada Is., B.C.	X	247
Ottawa Co., Que.	VII	290
Tulameen Dist., B.C.	VIII	200
Pyroxenite:		
Borough Tp., Ont.	VII	293, 295
Ottawa Co., Que.	VII	290
Platinum in	VIII	200
Rossland, B.C.	VII	49
Texada Island, B. C.	VIII	176
Pyrrhotite:		
Attraction of for residuum oil	VII	187, 188
Constituents of	X	274
Crushing	IV	208, 210
		222
Magnetic permeability of	VI	11
surveying of	V	377
Microstructure of	X	274–280
Nickel-bearing, in Canada	VII	280
Platinum associated with	VII	165
Sulphuric acid from, paper by SJOSTEDT	VII	480–494

British Columbia:		
Boundary District	V	368, 371
		373
	X	189
Coast Districts	IX	39
	X	195
Rossland District	V	451, 522
	VII	50, 56, 60
		63, 194
Vancouver Island, nickel in	IX	48
West Kootenay	II	76
Germany:		
Sohland nickel ores	IX	255
Norway:		
Deposits	VII	401–408
Float mine	VIII	207
Ontario:		
Atikokan, paper by HILLE	IX	285–301
Nipissing Dist.	IV	276
Notes by ADAMS	VII	395
Parry Sound	IV	210

	Vol.	Page
Pyrrhotite—Con.:		
Ontario—Con.:		
Rainy River Dist.	VI	333
Schreiber	VII	158
Sudbury Dist., Ont.	V	235, 532
		534, 536
	VI	406
	VII	481
	VIII	203
Quebec:		
Chibougamau	IX	221
Lake Dore	X	105
Mexico:		
Los Reyes gold mines	VIII	276
New Brunswick:		
St. Stephen	IX	237, 239
Yukon:		
Conrad	X	211
Pyrrhotite-norite:		
Norway nickel deposits	V	540
Sudbury Dist., Ont.	V	529

Q

Quarries:		
Boundary Dist., B.C.:		
Knob Hill mine	V	424
Mother Lode mine, plan	VII	42
Philipsburg, Que., limestone	V	47
Thetford, Que., asbestos	IV	7, 8
Quarrying:		
Asbestos in Quebec	IV	7, 8
	V	351
Bilbao iron mines, Spain	IV	200 et seq.
Boundary Dist., B.C., copper mines	V	215
	VIII	42, 46
Edison iron mines, N.J.	VI	17
Feldspar mines, Ontario	VII	166
New Caledonia nickel mines	V	544
Wabana iron mines, Newfoundland	III	131, 132
	IV	66, 67
Quarry Island, RAINY RIVER DIST., ONT.:		
Molybdenite	VI	49
Quarry Point, MIDLAND BAY, L. SUPERIOR	X	445
Quarternary:		
Russian oilfields	VI	113

	Vol.	Page
Quartz:		
Attraction of for oil	VII	187
Charge of in electric furnace	VIII	141
Crushing	IV	208, 210, 221
Effect of pressure on	II	127
Molybdenite in	VI	48
Origin	II	77
Nevada	VIII	41
notes by KNIGHT	VII	234
"Saddle reefs"	II	191 et seq.
Australia:		
Bendigo	II	247
British Columbia:		
Boundary Dist.	V	367, 369, 376
Bridge River	III	26, 27, 28
Franklin Camp	X	173
Kootenay East:		
Wild Horse Creek	III	3
Kootenay West	II	76
Lardeau Dist., Fish River	VII	95, 97
Poplar Creek	VII	105
Slocan Dist., Whitewater mine	III	171
Nova Scotia:		
Boisdale Hills	VI	414
Notes by FARIBAULT	II	119 et seq. 244 et seq.
Waverley, East	IV	45
Ontario:		
Atikokan	IX	291
Deloro mine	IV	114
Hastings Dist.	V	240
Lake of the Woods	II	87, 238
Michipicoten	VII	122
Quebec:		
Chibougamau	VIII	363
United States:		
Republic, Wash.	V	274
Goldfield, Nevada	VIII	41
Yukon:		
Conrad mining div.	X	211
Notes by MCCONNELL	III	209, 210, 212
SPURR	VII	234
Wheaton River	X	214
Windy Arm	IX	50
Quartz claims:		
Regulations respecting in Canada	VII	451 et seq
Quartz Creek, KLONDIKE, Y.T.	III	124
Quartz crystals:		
Hydro-carbons in	III	207

	Vol.	Page
Quartz drift:		
Klondike, description	III	125
gold values in	III	210
Quartz pebbles:		
Yukon, character and origin	III	209, 210
Quartz-porphyry:		
Ascot, Eastern Tps., Que.	V	82
Butte, Montana	V	297
Copper Mt., Similkameen Dist., B.C.	V	496, 498
Graphite in	VI	76
Lardeau Dist., B.C.	VII	89
"Quartz reefs":		
Goldfield, Nevada	VIII	40
Quartz-syenite:		
Boisdale Hills, C.B.	VI	421
Quartzite(s):		
Atlin Dist., B.C.	V	22
Boisdale Hills, C.B.	VI	424
Boundary Dist., B.C.	V	365, 366
		514
Kimberley, S. Africa, diamond mines	V	64
Kitchener, B.C., iron ore in	V	76
Lardeau Dist., B.C.	VII	89
Nova Scotia gold measures	II	120
Purcell Mts., E. Kootenay, B.C.	V	507
Silver-lead deposits in	V	514
Sudbury Dist., B.C.	V	529
	X	313
Quartzite series (Cambrian):		
East Kootenay, B.C., note by CARLYLE	V	507
Quatsino Sound, VANCOUVER ISLAND, B.C.:		
Copper ores	V	229
	VI	197, 198
Quebec City, QUE.:		
Annual meeting of Institute at, 1906	IX	1
Excursion of Institute to	IV	8
History of	IX	3
Quebec, PROVINCE OF:		
Asbestos production, 1879-1901	V	350
1901	V	570
Bureau of Mines	VI	482
Chromite production, 1900	IV	308
Copper	VII	397–399
Explorations in northern	X	105
Gold production, 1901	V	568
Graphite in	X	86
Iron industry	II	61, 62
mining possibilities in, paper by CIRKEL	X	108–117
ore production, 1900	V	565
sands	IV	91–98
Lead production, 1901	V	569
Mica industry in, notes by BELL	IV	305 et seq.
Mineral production, 1869-1871	IX	95
1899	III	182
1900	IV	293, 304
	V	564
1901	V	581
1902	VI	454

	Vol.	Page
Quebec, PROVINCE OF—Con.:		
Mineral water	VIII	89
Mining industry, 1898, notes by OBALSKI	II	62–65
1899	III	187–188
law, notes by COSTE	VII	455, 462
notes by OBALSKI	V	154
Molybdenite occurrences	VI	49, 50
Nickel	III	224
and cobalt discovery	II	62
Phosphate industry, 1898	II	64
Platinum in	VIII	211
Rare minerals in	IX	72
Serpentine in south-eastern	VIII	267–269
Silver production, 1901	V	569
Uranite occurrence in	VII	245
Water powers	X	111
Quebec Mining Association:		
Affiliation with Institute	I	19
Notes by SMITH	VIII	35
Queen iron mine, NEGAUNEE, MICH,. *see* Regent mines.		
Queen Charlotte Islands, B.C.:		
Coal analysis	VIII	237
measures	VII	424
Kootenay series in	VIII	221
Queensland:		
Artesian wells	VIII	84
Quesnelle Lake, CARIBOO DIST., B.C.	X	418
Quesnelle Mining Div., CARIBOO DIST., B.C.:		
Gold gravels	X	418
Quetachu River, MANIKUAGAU BAY, ST. LAWRENCE GULF, QUE.:		
Molybdenite	VI	50
Quicksilver, *see also* Amalgam, Cinnabar and Mercury.		
Canadian occurrences, paper by COLQUHOUN	II	13–16
Notes by MILLER	VI	35
World's production	VI	68
Quince River, PONTIAC CO., QUE.:		
Jaspilyte	IV	278
Quincy copper mine, MICHIGAN, U.S.A.:		
Paper by MCLAREN	X	399

R

Rabbit Lake, TIMAGAMI DIST., NIPISSING, ONT.:		
Brecciated rocks at	X	64
Rabbit Mt., THUNDER BAY DIST., ONT.:		
Silver on	VII	140
Rabbit Mountain mine, THUNDER BAY, ONT.:		
Vein at	VII	66
Rabbit's Foot copper claim, WHITEHORSE, Y.T.	X	198
Radium, *see also* Uranite, Monasite, Samarskite, etc.		
Economic uses	VII	252
Field-testing for	VII	252, 253
Paper by OBALSKI on Quebec mineral containing	VII	245–256

	Vol.	Page
Radnor Forges, ST. MAURICE COUNTY, QUE.	IX	4
Blast furnace at	VII	155
Bog iron ore	II	62
Establishment of	IX	4
Pig iron from	IV	305
Product	II	61
Radnor iron mines, RENFREW TP., ONT.:		
Notes on by CARTER	VII	152
Raglan Tps., RENFREW CO., ONT.:		
Corundum	V	164
	VII	415
works	V	242
Rails, *see under* Steel.		
Railways:		
Algoma Central, construction of	III	121
Boundary Dist., B.C., effect of	V	171 et seq.
British Columbia, fuel supplies, notes by BLAKEMORE	VI	224 et seq.
Building, electric drills in	II	182
Columbia & Western	V	171
Crowsnest Pass, B.C.	IV	234
subsidy to	IV	237
Government ownership of	V	126
Irondale, Ontario	IV	268
Lethbridge and Great Falls	IV	170
Nelson & Fort Sheppard, construction of	II	3
Rossland Dist., Great Northern	V	334
Slocan Dist.	VI	147
Sweden, Galliware iron mine	II	38
projected	II	39
Use of compressed air by	V	161
Railway transportation: *see* Costs, Transportation, etc.		
Rainbow claim, TELKWA RIVER, B.C.	X	222
Rainbow lode, BUTTE, MONTANA	X	255
Rainbow mine, SLOCAN DIST., B.C.	V	12
Rainfall:		
Disposition, notes by ADAMS	VIII	78
Hawaiian Islands	VII	70
Rainy Hollow Camp, near LYNN CANAL:		
Copper at	X	196
Rainy Lake region, ONT.:		
Diamonds in	III	159
Rainy River Dist., ONT.:		
Gold-bearing rocks of	VII	125
mining, 1900	IV	302
1901	V	580
notes by BRENT	VI	327
Pyrite deposit	X	124
Rakou oilfields, RUSSIA:		
Notes by COSTE	VI	87, 88
Raleigh Tp., KENT CO., ONT.:		
Natural gas in	X	78
Rambler mine, WYOMING, U.S.A.:		
Ores of, notes by DICKSON	VIII	204, 205
Platinum at	VIII	198
Rambler-Cariboo mine, SLOCAN DIST., B.C.:		
Concentrator	VI	152
	VII	372
Vein	V	11

	Vol.	Page
Rammelsberg, GERMANY:		
Pyrite deposit	x	119
Rand compressor:		
Compression curves from	viii	288, 289
Rand drill:		
Notes by PARLEE	vi	377
Rapid Creek, POPLAR CREEK DIST., B.C.:		
Formation at	vii	104
Gold ores on	vii	102, 104
Rapid River, MCKENZIE BAY, CHIBOUGAMAU, QUE.	ix	19, 222
****RARE EARTHS IN PEGMATITE VEINS,*** OBALSKI	ix	72–73
Rat Portage, ONT.:		
Gold-quartz	iv	221
†***RATE OF SOLUTION OF GOLD IN POTASSIUM CYANIDE.*** PLUNKETT	vii	192–193
Discussion on, by:		
THOMPSON, W., MILLS, MICKLE, PORTER	vii	193–198
Rateau, A.:		
Quoted on Bitumen in Galicia	vi	77
Galician oil fields	vi	101, 108
Rathbone, E. B.:		
On geology of Rossland Dist., B.C.	iii	165
Rawhide mine, BOUNDARY DIST., B.C.:		
Gold values	v	373
Raymond, Rossiter Worthington:		
Addresses as Secretary A.I.M.E., at Institute Meeting, 1900	iv	6, 10, 14, 15, 17, 18 26, 37, 50–52, 59, 60
On deep level shafts on the Rand	iv	40–41
development of Nova Scotia iron industry	iv	26
gold mining in California	iv	46
methods of testing cast iron	iv	41
testing wire rope	iv	43, 44
R. Bell mine, BOUNDARY DIST., B.C.:		
Ore deposit	v	368
READ, T. T.:		
Discussion by, on:		
The Distribution of Platinum Metals in Sources other than Placers	viii	214
‡***RECENT ADVANCES IN ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY,*** GOODWIN	iii	133–140
¶***RECENT DEVELOPMENTS IN MINING IN THE SOUTHERN YUKON,*** CAIRNES	x	209–217
Red Deer coalfield, ALTA.:		
Available coal supply per square mile	v	112
Red Deer River, ALTA.:		
Coal, quality of	x	234
seams	x	231, 236
Red Mountain, ROSSLAND DIST., B.C.:		
Minerals discovered on	v	447
Mines on	v	404
Ore Deposits on, paper by KIRBY	vii	47 et seq.
Veins	v	522

* See Summaries, page 112
† " " 79
‡ See Summaries, page 22
¶ " " 138

	Vol.	Page
Redding Creek, ST. MARY RIVER, B.C.:		
Cinnabar	III	144
Re-enforced concrete:		
Notes by LEONARD	VIII	109
Refineries:		
Nickel, Cleveland, U.S.A.	V	399
endeavour of Ontario Government to establish	III	229
Refining:		
Arsenic, Ontario	IV	122
Canadian Copper Company	III	246
Copper:		
Canadian opportunities	VI	314
Elkinton electrolytic process	V	193
notes by KOEHLER	V	189 et seq.
Copper-nickel matte	III	233, 234
Corundum	VII	160
Gold, Yukon Territory	II	257, 258
Marchese electrolytic process	V	192, 210
Nickel:		
Frasch process	IV	301
Mond process	III	231, 236
Orford process	III	244
	V	549
Platinum	VI	37
Rossland, B.C., charges	V	314
Silver, notes by MILLER	IX	14
Refdanskite (or REWDINSKITE)	IX	306
Regent mines, NEGAUNEE, MICH., U.S.A.:		
Paper by ATKINSON	VII	319–334
Regina, SASK.:		
Coal	VIII	242
Regina gold mine, LAKE OF THE WOODS, ONT.:		
Notes by CARTER	VII	132, 136
REIHLE, H. C.:		
**Note on Asbestos Mining in Asiatic Russia*	VI	372
†*RELATIVE ATTRACTION OF SOME COMMON MINERALS FOR RESIDUUM OIL.* HAMILTON, J. F.	VII	185–191
Discussion on, by:		
PORTER, MILLS, MICKLE, WALKER, ADAMS, KIRKPATRICK	VII	188–191
Reliance mineral claim, RAINY RIVER DIST., ONT.	VI	332
Rencontre, FORTUNE BAY, NFLD.:		
Molybdenite	VI	51
Renfrew County, ONT.:		
Allanite	VII	254
Corundum belt	III	200
Graphite	IV	303
	V	246
	X	86
mining in	VII	160
Marble	VII	390
Tin occurrence	VII	380

* See Summaries, page 71
† " " 79

	Vol.	Page
Replacement ore deposits, *see also* Ore Deposits.		
Boundary Dist., B.C.	v	368, 515 et seq.
Butte, Montana	II	82
Goldfield, Nevada	VIII	43
Loon Creek Dist., Idaho	IX	56
Rossland Dist., B.C.	v	521, 523
Slocan, B.C.	II	80
Sudbury Dist., Ont.	v	538
nickel	IX	229
West Kootenay, B.C.	II	79
Republic, Wash., U.S.A.:		
Cyanidation at	VII	195
Gold milling at, paper by CIRKEL	v	274–287
Republic Con. Gold Mining Co., REPUBLIC, WASH.:		
Gold milling	v	274
Hydrometallurgical plant	v	279
Republic Mt., SLOCAN DIST., B.C.:		
Silver-gold mines	v	12
Republic Power & Cyaniding Co., REPUBLIC, WASH.:		
Reduction plant	v	279 et seq.
Republic Reduction Works, REPUBLIC, WASH.:		
Cyanide practice and plant, notes by CIRKEL	v	279–287
Republic silver mine, SLOCAN, B.C.:		
Tests on ore from	VII	200
Note by JOHNSTON	v	11
Reserve colliery, GLACE BAY BASIN, CAPE BRETON:		
Description	IV	28
Residues:		
Non-amalgamable, treatment of	v	9
Residuum oil:		
Attraction of minerals for	VII	185–191
Resolutions of Institute, *see* Canadian Mining Institute.		
****RESPONSIBILITY OF MINING ENGINEERS AND MINING DIRECTORS, THE,*** WILLIAMS, H. J. C.	IX	281–284
†***RESULTS IN THE USE OF A ROTARY PUMP AS AGAINST STRAIGHT LINE TYPE,*** FERGIE	III	128–129
Retort coke, *see* Coke.		
Reverberatory furnaces, *see also* Furnaces.		
North Brookfield mine, N.S.	VII	311
Retreatment of matte and slag in	IX	58
‡***REVIEW OF PROGRESS IN THE MINERAL PRODUCTION OF BRITISH COLUMBIA,*** JACOBS	X	183–187
¶***REVISION OF THE MINES ACT OF ONTARIO, THE,*** CLARK	IX	113–114
Rhyolite:		
Goldfield, Nevada	VIII	40
Loon Creek Dist., Idaho	IX	55
Mason Valley Mts., Nev.	X	257
Rhyolite-porphyry:		
Copper in	X	255
Rhyolitic-breccia:		
Butte, Montana	v	297
Riblet aerial tramway:		
LeRoi mine, Rossland	v	332
Richard III copper mine, MT. SICKER, B.C.:	X	204

* See Summaries, page 122
† " " 22
‡ See Summaries, page 136
¶ " " 115

	Vol.	Page
Richardson, James:		
Mineral discoveries at Lake Chibougamau	IX	218
Min. ref.	IX	17
Richardson feldspar mine, BEDFORD TP., FRONTENAC CO., ONT.	VII	165, 286
Richardson gold mine, MADOC TP., HASTINGS CO., ONT.	VII	117
Richardson Gold Mining Co., NOVA SCOTIA.	IV	311
Richardson gold mine, ISAAC HARBOUR DIST., N.S.:		
Geological formation	II	246
Gold occurrence	II	125
Richmond, QUE.:		
Logan's work near	X	359
***RICHNESS OF COBALT ORES,** LEDOUX	X	72–73
Discussion on, by CAMPBELL	X	73
Riddle's, DOUGLAS COUNTY, OREGON	IV	185
Genthite, analyses.	IX	307
Saxonite	IX	315
Ringerike, NORWAY:		
Copper-nickel deposits.	VII	404
Rio Tinto, SPAIN:		
Copper mines	VI	34
Pyrite deposit	X	119
Ores, origin.	X	254
Ritchie, S. J.:		
Nickel mines acquired by.	VII	496
Ritchie mine, RITCHIE CO., VA., U.S.A.:		
Grahamite	VI	104
River Rouge, ARGENTEUIL CO., QUE.:	X	369
Road(s):		
Bridge River Dist., B.C.	III	28
Road making:		
Yukon	III	211
Roaster:		
Anaconda Mining Co.	VIII	350
Roasting:		
Cobalt ores.	X	74
Copper sulphide ores	IV	123
Distribution costs	V	336, 337
Gold ores, North Brookfield, N.S.	VII	310
Iron ores.	II	50
preliminary to electric smelting	X	133
McDougall furnace, paper by SORENSEN	VI	306–316
Sweden	II	222
Nickel-copper ores	V	544
	VII	150
Republic mill, Republic, Wash.	V	283
Silver ores before cyaniding.	V	286
Sudbury Dist., Ont.	V	544
	VII	150, 482
experiments	VII	482
Zinc ores for magnetic separation	VII	376
Zinc-iron sulphides	VII	275
Roasting-gas:		
Notes by SJOSTEDT.	VII	486
Roasting oven, *see* Furnaces, etc.		
Roasting plant:		
Sudbury, Ont., description of	VII	481

* See Summaries, page 128

	Vol.	Page
Robb, W. D.:		
Elected Councillor, 1905	VIII	34
1906	IX	27
ROBBINS, FRANK:		
**A Simple and Convenient Instrument for Mine Surveys*	IV	99–106
ROBERTSON, JOHN J.:		
†*Cyanide Tests on Temiskaming Ore*	IX	396–401
Prize awarded to, 1907	X	6
Robertson, J. Roderick:		
Death	V	557
Resolution of Institute respecting	V	559
Robertson, W. Fleet:		
Elected Councillor, 1904	VII	22
Vice-President, 1907	X	17
Notes by on British Columbia mineral production, 1901	V	572–574
Min. refs	VI	440
	X	218
Robertson-Beatson copper claim, LA TOUCHE ISLAND, ALASKA	X	202
Robillard corundum deposit, RAGLAN TP., ONT.	V	164
Robinson, A. H.	II	107
ROBINSON, A. W.:		
‡*The Stewart River Gold Dredge*	VI	214–223
Robinson, F. C.	X	249
Robinson, Y.T.:		
Gold and tellurides discovered near	X	213, 214
Robison, Col. W. B.	IX	305
Roche Percee coal mine, SOURIS, SASK.	VI	374
Coal production, 1901	V	518
Rock(s):		
Action on of thermal waters	II	78
Alkalies replaced by magnesia	II	78
Drilling hard	VI	378
Movements:		
Laurentian and Huronian areas, paper by MILLS.	VII	177–184
Pressure, *see also* Pressure.		
Notes by COSTE	VI	119
Welland Co., Ont.	VI	115, 474
Western Ohio oil wells	III	84
Sections:		
Emma mine, Boundary Dist., B.C.	X	191, 192 193
Rock Breakers, *see also* Crushers, Ore Crushers, etc.		
Bells' asbestos mine	IV	7
Cyclone pulverisers	IV	7
¶*ROCK DRILLING AND BLASTING,* PARLEE	VI	376–389
Rock Lake copper mine, ABERDEEN & PLUMMER TPS., ALG., ONT.:		
Notes on by CARTER	VII	145
Rock Lake Mining Co., BRUCE MINES, ONT.	IV	301

* See Summaries, page 26
† " " 126
‡ See Summaries, page 65
† " " 72

	Vol.	Page
Rocky Mountains, *see also* Crowsnest Pass.		
Coal, age of	VIII	238
character of	V	106
	VIII	238
eastern slopes of	VI	225
in foothills	V	106
	VII	423
	X	234
fuel ratios	X	230
origin	VII	422
Cretaceous formation	VII	422
Glaciation	V	107
Geological history	VIII	221
KEMP, notes by, on igneous origin of ores in	X	310
Mineral wealth, notes by THOMPSON	VII	468
Mining Possibilities in, paper by MACDONALD	VI	337
Silver-lead deposits	V	514
Volcanic activity, evidences of	VII	501
Rocky Mountain House, NORTH SASKATCHEWAN RIVER, ALTA., *see* Acton House.		
Rogers, H.	VII	102
Rolling mills:		
Sandviken, Sweden	II	219
Rolls:		
Allis	IV	255, 259
Challenge type	II	36
Corundum concentration	V	166, 168
Crushing with, notes by PORTER	IV	210, 214
		218, 220
		221–223
efficiency	IV	190
Designs of	II	35
Helena Frisco mill, Idaho, U.S.	IV	255, 256
		259
Practicable peripheral speeds of	II	34
Types	II	33
Romney oilfields, KENT COUNTY, ONT.:		
Paper by COSTE on geology of and operation in	X	77
Rope:		
Aerial tramway, tension	IV	134
***ROPE DRIVEN VERSUS DIRECT DRIVEN COLLIERY VENTILATING FANS,** PEACOCK	IV	107–112
Rope transmission:		
Ventilating fans	IV	111
Roros copper mine, NORWAY	VII	402
Rose, Hugh	VII	58
Ross, Sir Charles	VI	181
Ross, Hon. James H.:		
Views on transportation in Yukon	V	576
Ross, P. S., & Sons:		
Appointed auditors of Institute, 1906	IX	13
Ross coal seam, EDMONTON, ALTA.	X	236
Ross Tp., RENFREW CO., ONT.:		
Molybdenite	VI	49
Rossi, A. J.	X	139

* See Summaries, page 26

	Vol.	Page
Rossland Dist., B.C.:		
Air compressing, paper by THOMPSON	VI	180–'87
Coal, price in	VI	182
Drilling costs in	IX	389
Geological map	V	504
Geology	II	74
	III	163
history and mining, paper by CAMPBELL	V	447–483
notes by CORLESS	V	519 et seq
note by HARDMAN	V	121
LeRoi mine	V	310 et seq
Mattes	II	118
Meeting of Institute, 1899	III	163–165
Mine contract-labour	V	323, 324
surveying methods in	VIII	317
Mineral production, 1897-1901	III	185
	V	477, 478
Mineralization	III	163
Ore deposits, notes by CORLESS	V	518
paper by KIRBY	VII	47–58
Ores, freight and treatment charges	VI	228
Pyrrhotite	IV	208, 210 222
gold values	VII	194
Timbering, paper by MACDONALD	VI	129–141
Volcanic rocks	V	507
Rossland Great Western mine, ROSSLAND, B.C.:		
Air compressing plant	VI	183
Production, 1894-1904	VII	47
Rossport, THUNDER BAY DIV., ONT.:		
Iron pyrites at	VII	158
Gold mining at	VII	124
Lead and zinc occurrences near	VII	155, 156
Rotary pumps:		
Advantages of	III	129
Röttisite	IX	306
Roumania oilfields	VI	101, 108
Round Lake, ALGOMA, ONT.:		
Copper mining at	VII	147
Rowand Cross separator	VI	57
Rowe's Brook, DUDSWELL TP., QUE.:		
Placer gold in	VIII	260
Rowe's shaft, BRUCE MINES, ONT.	X	159
Rowsell Harbour, LABRADOR:		
Pyrite deposit	VI	391
Roxton, SHEFFORD CO., QUE.:		
Copper mines	V	81
	VIII	182
Royal Military College, KINGSTON, ONT.	V	145
Royalties: (on minerals.)		
India	VI	486
Institute's action regarding	VII	32
Mexico, on gold and silver	V	151
Nova Scotia and New Brunswick	VII	456, 458
Ontario:		
abolition of	VII	269
notes by CLARK	III	110
	IX	114
	X	340–1

	Vol.	Page
Royalties—Con.:		
Ontario—Con.:		
petroleum	X	80
proposed imposition of	IV	290
Provinces' prerogative to impose	III	113
Quebec:		
exemption from	III	213
provisions respecting	VII	455
SJOSTEDT'S views	V	142
Yukon:		
collected, 1900	IV	295
1901	V	576
exemption	III	215
notes by COSTE	III	212
TYRRELL	III	215, 221
resolution of Institute respecting	III	221, 222
***ROYALTIES ON MINERALS IN ONTARIO,** CLARK	X	340-341
"Rubio":		
Limonite, Bilbao, Spain	IV	200, 202, 203
Ruby Creek, ATLIN DIST., B.C.:		
Notes on by GWILLIM	V	26 et seq.
Ruby silver claim, CONRAD, Y.T.	X	213
Rush copper claim, PRINCE OF WALES ISLAND, ALASKA	X	204
Russell, Alexander	IX	91
Russell, Andrew	X	351
Russell claim, TELKWA RIVER, B.C.	X	222
Russia:		
Apcheron, near Baku, oilfields	III	87
	VI	117
Asbestos mining in	VI	372
production, 1900-1901	V	347
Bakou, Caspian Sea, petroleum	VI	87
Baron Girar de Soukanton asbestos mine	VI	372
Bisersk Dist., platinum in	VIII	201
Coal production, 1850-1900	VI	31
Gold production, 1801-1900	VI	25
Goroblagodat Dist., platinum occurrences	VIII	196, 201
Iron ore deposits	IV	25
production, 1899	III	120
reserves	X	141, 146
and steel production, 1807-1900	VI	29
Krivoi Rog, iron ore	IV	25
Lala River, platinum in	VIII	196
Loswe River, platinum in	VIII	196
Nischay-Tagilsk Dist., platinum in	VIII	193, 196
Oilfields	VI	108
Platinum	VI	36
	VIII	196, 201
discovered in	VIII	193
production	VIII	194, 195
Quicksilver deposits	VI	35
Ruth concentrator, SLOCAN DIST., B.C.	VI	152
Ruth mine, SLOCAN B.,C.	VII	372
RUTHERFORD, F. N.:		
†***Chloridizing Treatment of Nickle Ores***	VIII	336-342

* See Summaries, page 146

† See Summaries, page 107

	Vol.	Page
Rutherford, Prof.:		
Cleveite, Saguenay, Que., tested by	VII	247
Rutherford Tp., ALGOMA, ONT.:		
Iron in	VII	258
Ruthven, S. GOSFIELD TP., ESSEX CO., ONT.:		
Natural gas	III	68

S

Saanich Inlet, VANCOUVER ISLAND, B.C.:		
Formation	VI	189
Sabbath observance:		
In Nova Scotia mines	II	246
Sabawe Lake, ATIKOKAN DIST., ONT.:		
Dyke	V	57
Nickel prospecting near	IX	299
Sacking:		
Concentrate, costs of	VI	160
Saddle reefs:		
Bendigo, Australia	II	125
	IV	45, 48
Lazarus mine	II	125
Johannesburg, South Africa	IV	48
Nova Scotia:		
notes by STUART	IV	45
paper by FARIBAULT	II	119 et seq.
Safety lamps:		
Ashworth-Hepplewhite-Gray	V	390
Ashworth and Stokes, relative merits	VI	206
BLAKEMORE'S views on	VI	200 et seq.
Benzolene in	VI	207
Coal dust, behaviour in gauze mesh of	VI	205, 206
Dangerous conditions in collieries, for use of	V	389
Effect of explosion within	VI	206
Fire damp percentage, indicated by "cap" heights	VI	210 et seq.
Filling	VI	207
for Gas testing	V	390, 392
Ignition of coal dust inside of	VI	207
Introduction of in mines	VI	23
Marsant's experiment	VI	207
Nova Scotia collieries	VI	447
Report Royal Commission	VI	212
SAFETY LAMPS AND COLLIERY EXPLOSIONS, ASHWORTH	V	379–392
Discussion on, by:		
BLAKEMORE, HARDIE, ASHWORTH	VI	200–213
Saguenay Dist., QUE.:		
Cleveite	VII	245
Mica occurrences	VII	304
Sain-Bel, FRANCE:		
Pyrite deposit	X	119
St. Andrew's channel, C.B.	VI	411
St. Ann, VICTORIA CO., N.S.:		
Tripolite production from	IV	312

See Summaries, page 54

	Vol.	Page
St. Ann Hills, BOISDALE HILLS, C.B.	VI	411
St. Catherines, ONT.:		
Natural gas	III	80
Petroleum horizons	III	82
Power works near	VIII	109
St. Charles iron mine, HASTINGS CO., ONT.	VII	152
St. Eugene silver-lead mine, MOYIE, B.C.:		
Notes by CORLESS	V	511
St. Flavien, LOTBINIERE CO., QUE.:		
Copper mines	V	81
	VIII	182
St. Francis River, CHAUDIERE RIVER, QUE.:		
Placer gold in	VIII	262
St. John, N.B.:		
Graphite from	X	92
St. John River, GASPE CO., QUE.:		
Iron sands	IV	95
St. Laurent, QUE.:		
Artesian wells at	VIII	93
St. Lawrence River, QUE.:		
Formation on	VIII	86
Iron sands	II	62
	VI	12
analysis	IV	92, 93, 94
	X	109
paper by OBALSKI	IV	91–98
treatment	VII	274, 277
		278, 279
		282
St. Lawrence Valley:		
Copper ores in	VIII	182
St. Mary River, BELLY RIVER, ALTA.:		
Coal on	X	234
St. Mary's River, KOOTENAY RIVER, B.C.:		
Formation	V	507
Edmonton series	VIII	223
St. Maurice County, QUE.:		
Early mineral discoveries in	IX	4
St. Maurice River, QUE.:		
Bog iron ore	II	48
Drainage area	II	48
Iron smelting	II	48
Water power	III	139
St. Ours, RICHELIEU CO., QUE.:		
Artesian water at	VIII	90
St. Pierre, MARTINIQUE ISLAND:		
Destruction of	VI	80
St. Stephen, N.B.:		
Nickel deposits	III	225
notes by CAMPBELL & KNIGHT	X	274–280
paper by DICKSON	IX	236–260
Sakoose gold mine, LAKE OF THE WOODS, ONT.:		
Note by BRENT	VI	331
Notes by CARTER	VII	132, 138
Salda River, RUSSIA:		
Platinum in	VIII	196
Salengen, NORWAY:		
Iron concentration at	X	270

	Vol.	Page
Saline waters, *see* Mineral Waters.		
Salmon River Dist., NELSON DIV., B.C.:		
Gold occurrence	II	125
Physiographical features, notes by FOWLER	III	3, 4
Relation of dykes to ore bodies	II	83
Salse(s):		
Notes by COSTE	VI	85, 86, 89
Salt:		
Canadian production, 1901	V	572
1902	VI	455
New Brunswick, royalty on	VII	456
Ontario production, 1893–1903	VII	392
1900	IV	304
1901	V	581
1902	VI	464
Salt coke:		
Cost of producing	III	130
"Salt islands":		
Texas and Louisiana oilfields	VI	114
Salt water:		
In oil and gas wells	III	75, 77, 87
	VIII	100
Salting (gold mines):		
Note by WILLIAMS	IX	284
Saltpetre:		
Notes on production and uses by MILLER	VI	41
Salzburg mine, GERMANY:		
Drilling	II	177, 178, 181
Sample grinder:		
Results with, notes by PORTER	IV	212, 214, 218
Sampling:		
Anodes	II	226, 227
Arsenic, influence of in copper	II	110, 113
Argentiferous lead	II	114
Athabasca mill, Nelson, B.C.	IV	87
Borings	II	238
Check	III	17
Chili copper bars	II	108
Costs	V	336, 337
Northport smelter	V	318
Copper, paper by LEDOUX	II	108–118
Deloro, Ont., concentration products	IV	121
Dip samples	II	118
Drill cores	V	454
Eighteen hole method	II	115
Five bar method	II	114
Greenwood smelter, methods	IX	353
Guess' amalgamating device	I	10
Iron, Midland furnace	X	445
notes by CRAIG	VI	295
Laboratory amalgamation tests	I	10
Lead bullion	II	108
LEDOUX, notes by	VI	471
paper by	II	108 et seq.

	Vol.	Page
Sampling—Con.:		
LeRoi mine, Rossland	v	331, 422
Method of determining the milling value of ores	i	12
Mineral claims	iii	143
Pulp, from leaching vats	iv	145
Republic, Wash.	v	282
Sawing	ii	116
***SAMPLING OF ARGENTIFEROUS AND AURIFEROUS COPPER, THE,** LEDOUX	ii	108
Discussion on, by:		
HARDMAN, DOUGLAS	ii	226, 227
Sampling plant:		
LeRoi mine, Rossland	v	330
Republic, Wash.	v	281, 282, 287
San Antonio, NEVADA, U.S.A.	viii	39
San Benito iron mine, SPAIN, *see* Spain:		
San Domingo vein, RIO TINTO, SPAIN, *see* Spain.		
San Jose, MEXICO:		
Copper occurrence	x	254
San Juan Harbour, VANCOUVER ISLAND, B.C.	vi	188, 199
San Juan River, VANCOUVER ISLAND, B.C.:		
Minerals, notes by BEST	v	230
San Miguel Peras District, MEXICO:		
Formation near	viii	272
Veins in	viii	273, 274
San Pedro, NEW MEXICO:		
Copper, occurrences	x	254
San Rafael gold mines, SAN MIGUEL PERAS, MEXICO	viii	274, 276
Sand:		
Auriferous, Wreck Bay, Vancouver Island, B.C.	v	231
Canadian statistics, 1902	vi	455
Meaning of term by petroleum drillers	iii	80
Qualities for cement making	viii	104, 107
Sandberger, Dr. F.:		
Quoted on Norway nickel deposits	v	540
Sandon, SLOCAN DIST., B.C.:		
Ore deposits	v	509
Railway construction at	vi	147
Relation of dykes to ore bodies	ii	83
Sandstones:		
Bilbao Dist., Spain	iv	199
Boisdale Hills, C.B.	vi	424
Cascade coal basin, Alta.	viii	226, 229
Lardeau Dist., B.C.	vii	89
Nastapoka Islands, Hudson Bay	v	256
New Glasgow, N.S.	v	359
Sandstorm gold claim, GOLDFIELD, NEVADA	viii	39
Sandvik steel works, SWEDEN, *see* Sweden.		
Santa Clara coalfield, SONORO, MEXICO.		
Volcanic action	viii	240
Santa Cruz Dist., CAL., U.S.A.:		
Bituminous sands	vi	107
Santa Maria di Pugliano	vi	83
Santa Rosa, CALIFORNIA, U.S.A.:		
Platinum occurrence	viii	198

* See Summaries, page 9

	Vol.	Page
Santander Province, SPAIN, *see* Spain.		
Santorin, GREEK ARCHIPELAGO:		
Eruption	VI	83
Sapphire:		
Legendary medicinal properties of	VII	411
Sarita River, ALBERNI CANAL, VANCOUVER ISLAND, B.C.:		
Iron ores	V	229
	VI	199
Saskatchewan:		
Coal and coalfields, paper by DOWLING	X	229–241
horizons	VIII	223
industry, 1900	IV	299
mining, 1902, notes by SMITH, F. B.	VI	374
regulations	V	111
production, 1902	VI	445
Laramie formation in	V	105
	X	234
Saskatchewan Gold Proprietary, Ltd.	V	577
Saskatchewan River, SASK.:		
Coal on	X	231, 233
analysis	VI	225
Gold dredging	IV	297
	V	90
notes by BELL	V	577
Saskatchewan Gold and Platinum Proprietary Company	IV	297
Sassuno, ITALY:		
Salse at	VI	86
Sassuolo, ITALY:		
Salse at	VI	86
Sault Ste. Marie, ONT.:		
Blast furnace at	VII	155
Copper-nickel refining	V	393 et seq.
Early copper mining near	VII	143
Electric smelting	III	139
Iron outcrops near	IV	280
mines near	VII	154
Nickel refining at	V	208
Steel trade, 1903	VII	425
SAUNDERS, W. L.:		
***Compressed Air**	V	156–163
Savant Lake, THUNDER BAY DIST., ONT.:		
Gold at, alluvial	VII	118
Savannah, N. CAROLINA:		
Sillimanite-gneiss rocks at	IX	311
Savona, KAMLOOPS DIST., B.C.:		
Cinnabar	VIII	181
Saw Bill gold mine, RAINY RIV. ,ONT.:		
Vein at	VIII	190
Sawbill Lake, RAINY RIVER DIV., ONT.:		
Formation at	VIII	184
Saw dust:		
Blast furnaces fuel	II	42, 48, 216
		224
Calcium carbide manufacture	II	232
Charged with iron in electric furnace	VIII	137

* See Summaries, page 44

	Vol.	Page
Saw dust—Con.:		
Generating gas from	V	182
Producer gas from	II	47, 51
in Sweden	IX	328
Sawmill waste:		
Use in iron making	II	50
Saxonite:		
Douglas County, Oregon	IX	315
Sayer's Lake, MICHIPICOTEN, ONT.:		
Pyrite at	X	122
Saytzeff, Prof.:		
Quoted on platinum occurrences	VIII	201
Scaliger, Julius Caesar:		
Platinum described by	VIII	192
Scenery:		
Influence of geology on	VII	177
Schist(s):		
Alberni Dist., V. I.	VI	197
Belmont, Peterborough Co., Ont.	VII	220
Boundary Dist., B.C.	V	514
Lardeau Dist., B.C.	VII	89
Mt. Sicker Dist., B.C.	IX	47
Nelson Dist., B.C.	V	15
Parry Sound, Ont.	VII	121
Peterborough Co., Ont.	VII	217
Rainy River Div., Ont.	V	53
Sultana mine, Ont., auriferous	II	98
Western Ontario, notes by BRENT	VI	327
Yukon, Y.T., auriferous	III	212
Schmidt, Henry	VII	102
Schnabel, Carl:		
Electro-metallurgy, classification	V	400
Schneeberg, GERMANY:		
Bismuth ores	VI	40
School of Practical Science, TORONTO:		
Mining society, affiliation with Institute	VII	9
Schule dry concentrator:		
Molybdenite	VI	55
Schuler diamond mine, S. AFRICA	V	62
Scio, OHIO, U.S.A.:		
Oilfields	VI	117
Schreiber, ONT.:		
Pyrite deposit	VII	158
	X	124
Scotch gauze lamp:		
Effect of fire-damp on	V	379
Scotch Lake, BOISDALE HILLS, C.B.	VI	411
Scotland, *see also* Great Britain:		
Bituminous shales	VI	114
Foyers, aluminium works	III	137, 138
Gallowscrook, Bitumen	VI	77
Iron production and quality, 1901	V	132
Lothians, oil-shales	VI	117
Technical education in	V	146

	Vol.	Page
SCOTT, O. N.:		
***Ore Deposits of Copper Mountain, Similkameen District, B.C.**	v	493–502
Awarded President's gold medal	vi	453
Scott's shaft, BRUCE MINES, ONT.	x	159
Scramble min. claim, RAT PORTAGE, ONT.	vi	332
Scrantz mill	iv	263
Screens, *see also* Milling.		
Australia	ii	155
Bertelett	ii	5
Burr slot vs. wire	iv	119
Coal Creek colliery, B.C., speed and inclination	iv	240
Deloro mill, Ont.	iv	115
Dredge	vi	218 et seq.
Magnetic separation of oversize products from	vi	57
Measurements, definition of	ii	206
standard	ii	6
Notes on, by DEKALB	ix	64
Slope of, in stamp mill practice	ii	152, 154
Varieties of	ii	154
Wear, cause of undue	ii	153
Screen-house:		
Coal Creek colliery, B.C.	iv	240
Screening:		
Anthracite	ix	261
Brayton Domain colliery, England	ix	407
Coal Creek colliery	iv	166, 240
Highland Boy, Utah, notes by SORENSEN	vi	310
LeRoi mine, Rossland	v	333
Pulp from plates, effect on concentration	iv	119, 120
Slocan Dist., B.C., galena	vi	156
Seaham colliery:		
Fire damp explosion	vi	205
Seattle, WASH., U.S.A.:		
Mint returns, Yukon gold	iii	214
Sechart Peninsula, BARCLAY SOUND, V.I., B.C.:		
Iron ore	v	229
Second Relief mine, SALMON RIVER, B.C.	iii	3
Secondary enrichment, *see also* Ore Deposits.		
Boundary Dist., King Solomon mine	v	375
Butte, Montana	v	298
Cobalt Dist.	x	53, 70
Ducktown, Tenn.	v	298
Notes by HIXON	x	56
KEMP on	x	252
Sudbury Dist., Ont.	v	235
Secretary of Institute, *see* Bell, B. T. A. and Lamb, H. Mortimer-		
Sedimentary rocks:		
Silver-lead deposits in	v	514
South-eastern British Columbia	v	506 et seq.
See, Horace:		
On testing wire rope	iv	42
Seismic disturbance, *see* Earthquakes.		
Selkirk range, ROCKY MTS., B.C.:		
Altitude	vii	87
Elevation of	x	229

* See Summaries, page 56

	Vol.	Page
Selkirk series:		
W. Kootenay, B.C.	v	506
SELWYN, DR. ALFRED R. C.:		
Animikie formation thickness estimated by	vi	253
Appointed Director Geological Survey	ix	94
Coal in Crowsnest Pass estimated by	iv	232
Death	vi	(x)
Paper by, on:		
Gold Mining in Nova Scotia, 1860 to 1899	ii	162
Portrait of presented to Survey	v	563
Resignation of, as Director of Geological Survey	ix	99
Views on remuneration of Government geologists	ix	98
Separation, *see* Magnetic Separation.		
Sepiolite:		
Analysis	ix	307
"Sepidodendron":		
Boisdale Hills, C.B.	vi	417
Sericite:		
Lardeau Dist., B.C.	vii	89
Ferguson	vii	98
Serpentine:		
Asbestos in	v	351
Atlin Dist., B.C.	v	21
Boundary Dist., B.C.	v	365, 366
		369
British Columbia, notes by Brock	vi	485
Chibougamau Dist., Que.	viii	367
	ix	19
magnetic	viii	366
Derivation of	viii	267, 268
Douglas County, Oregon	iv	186
Eastern Tps., notes by Hunt	vi	169
Kimberley diamond field	iii	156
New Caledonia	vi	169
	ix	315
nickel deposits	v	544
Nickel in	ix	315
Quebec, southeastern, paper by Dresser	viii	267–269
Tulameen Dist., B.C.	viii	200
Use of in road-making	vi	431
Seville Province, Spain:		
Iron ore	iv	196
Sewer pipe:		
Ontario production, 1902	vi	464
1903	vii	430
Sewerage system:		
Chicago	iii	32
Shafts:		
Athabasca mine, Nelson, B.C.	v	15
Brayton Domain colliery, England	ix	404 et seq.
Bruce mines, Ont.	x	150
Centre Star, Rossland, B.C.	v	455
Cages for	vi	303
Copper Queen mine, Texada, B.C.	viii	173
Emma mine, Boundary Dist., B.C.	x	193

* See Summaries, page 13

	Vol.	Page
Shafts—Con.:		
Hoisting compartments of	v	342
Ironsides mine, Phoenix, B.C.	v	430
Leckie iron mine, Torbrook, N.S.	ix	31
LeRoi mine, Rossland, B.C.	v	315, 324
	v	404, 464
Lining:		
cement for	vii	434
plan of	vii	360
steel for	vii	356
costs of	vii	361
McArthur nickel mine, Sudbury Dist., Ont.	v	529
New Bultfontein diamond mine, S. Africa	v	64
Oray claim, Kitchener, B.C., sketch of	v	80
Pioneer iron mine, Minn.:	vii	338
plan	vii	339, 353
		354
Quincy copper mine	x	461
Regent iron mines, Mich.	vii	319
Richardson mine, N.S.	ii	246
South Africa, deepest	iv	40
Sultana mine, Ont., sinking of	ii	87
Surveying in	viii	325
Timbering	v	420
Shaft-sinking:		
Acetylene gas as illuminant in	ii	228
Centre Star mine, Rossland, B.C., methods	v	455
Costs of, how chargeable in mine accounting	iii	62
Drills	v	484
Nova Scotia gold mines	ii	245–246
Pioneer iron mine, Ely, Minn.	vii	352
South Africa, average rate per month	ii	245
DeBeers diamond mine, method of	iii	155
Transvaal, deep vertical	iv	40–41
Sultana mine, Ont.	ii	237
Yukon, methods	v	575
Shaft stations:		
Centre Star mine, Rossland, B.C.	v	460
cross section and plan	v	483
Shakespeare gold mine, SHAKESPEARE TP., ALG., ONT.	vii	121
Shakespeare Tp., ALGOMA, ONT.:		
Gold discoveries in	vii	121
Shakerley colliery, LANCASHIRE, ENGLAND:		
Explosion at	v	385
Shaking-screen, *see* Screens.		
Shales:		
Belle Plain, near Regina, Sask.	viii	241
Bituminous, notes by HUNT	vi	114
Elk River, East Kootenay	iv	233
New Brunswick	vi	474
Pictou County, N.S.	v	358
Boundary Dist., B.C.	v	367
Cascade River valley, Alta.	viii	229
Coal-bearing, Pictou County, N.S.	v	358
Calcareous, Bilbao Dist., Spain	iv	202
Kettle Point, Lake Huron	ii	186
Medina, Western Ontario	ii	208
Nastapoka Island, Hudson Bay	v	256
Ohio, U.S.A.	vi	117

	Vol.	Page
Shales—Con.:		
Oil in, notes by COSTE	VI	117
origin	VI	78
Purcell Mts., E. Kootenay, B.C.	V	507
"Protosalvinia"	II	190
Shansi coalfields, CHINA	VIII	113
Sharbot Lake, OSO TP., FRONTENAC CO., ONT.:		
Corundum at	VII	417
Sharp, Alexander:		
Discussion by, on:		
The Influence of Government on Mining	VI	366
Sharp Creek, SKEENA DIV., B.C.:		
Coal seams	X	226
Shaughnessy, Martin O.	X	437
Shaw, Flora:		
Notes by, on Yukon	V	600
Shaw's coal mine, FISH CREEK, ALTA.	X	236
Shaw's gas-testing machine	VI	203
Shawenegan Falls, ST. MAURICE RIVER, QUE.:		
Water power	III	139
Shawinigan falls, *see* Shawenegan.		
Shawinigan Power Co., SHAWENEGAN, QUE.	III	139
Shear zones:		
Rossland Dist., B.C.	V	520
fissures	V	451
Sheaves:		
Notes by GARDE	VI	305
Shebandowan Lake, THUNDER BAY DIV., ONT.:		
Gold at, notes by CARTER	VII	124
Sheffield Tp., ADDINGTON CO., ONT.:		
Molybdenite	VI	51
	VII	164
concentration test	VI	52
Shefford County, QUE.:		
Bornite ores in	VIII	182
Shefford Mt., QUE.:		
Texture of rocks on	IX	213
Sheep Creek coal mine, LINEHAM, HIGH RIVER DIV., ALTA.	X	236
Sheep Creek, HIGHWOOD RIVER, BOW RIVER, ALTA.	X	231
Coal on	X	234
analysis	VIII	237
mining	V	108
Shenstone, Jos. N.	VII	414
Sheppard, Forrest	X	149
Sherbrooke, QUE.:		
Organization of Institute Branch	V	607
Visit of Institute to, 1900	IV	4
Sherbrooke copper mine, SHERBROOKE, QUE.	V	82
Sherbrooke Tp., SOUTH LANARK CO., ONT.:		
Mica "belt"	VII	289
Shields, Cornelius:		
Death of	VIII	4
Shining Tree Lake, NIPISSING DIST., ONT.	IV	277
Jaspilyte	IV	278, 280
SHIPPING COAL BY THE AERIAL WIRE ROPE SYSTEM AT PORT MORIEN, CAPE BRETON, HUDSON	IV	131–134

‡ See Summaries, page 28

	Vol.	Page
Shipping pier:		
Port Morien, C.B.	IV	131
Shirebrook, NOTTINGHAMSHIRE, ENG.:		
Colliery explosion, report on	V	386 et seq.
Shirley, Lionel:		
Death	V	557
Shoes (AND DIES):		
Types of	IX	67
Shogonosh, J.	IX	285
Shuswap series:		
West Kootenay, B.C.	II	72
	V	506
Shutes:		
Ironsides mine, Phoenix, B.C.	V	442
Shuttleworth, Prof. E. B.:		
Analysis of Tilbury natural gas by	X	79
Siberia:		
Asbestos mining in	VI	372
Gold mining,	VI	26
Platinum occurrences	VIII	201
Sicily:		
Celestite	VI	44
Sickingen, Graf von	VIII	193
Siderite, *see also* Iron.		
Bilbao Dist., Spain	IV	200
Magnetic permeability of	VI	11
Michipicoten iron range	X	122
Steep Rock Lake, Ont.	V	55
Whitewater mine, B.C., silver in	III	171
Siemens (and Halske) electrolytic process:		
Description	V	195, 198
Notes by ULKE	V	393
Siemens Brothers:		
Open-hearth furnace devised by	X	374
Siemens, Sir C. William:		
Dynamo improved by	III	134
on Gases in earth's interior	VI	84
Siemens electric drill	II	172, 176
Siemens-Martin furnace	II	41
Siemens open-hearth furnace:		
Development of	VIII	154
Sierra Madres, MEXICO.		
Altitude of	VIII	272
Sifton, Hon. Clifford	VII	446
"Sigilaria":		
Boisdale Hills, C.B.	VI	417
Signals:		
Code	VI	163
Mine, paper by MACDONALD & THOMPSON	VI	161–168
Oldham gold mine, N.S.	X	433
Quincy copper mine	X	414
Silesia:		
Chrysoprase earth	IX	308
Silica:		
Boundary Dist., B.C., in ores	V	173
Determination of	V	43
	VI	293
	X	449
in corundum rock	IV	182
Use, converter lining	V	549

	Vol.	Page
"Silicate ores":		
Boundary Dist., B.C., analyses	v	516
Silicification:		
Boundary Dist., B.C.	v	369
Silicon:		
Effect of on steel	v	38
	x	394
Silurian:		
Hydrocarbon, products	iii	83
New Caledonia	vi	169
Nova Scotia	ii	119
Ontario, Eastern	vii	210
Hastings Dist.	v	240
South-western	iii	78
Tilbury oilfield	x	82
Welland Co.	iii	80
Oil and gas horizons in	iii	82
Quebec, Ottawa Co.,	vii	290
Silver and silver mining:		
Cyaniding	v	286
Graphite in veins of	x	98
Melting	v	7
Production 19th century, notes by MILLER	vi	33 et seq.
Royalties on: Crown's right to levy	iii	113
Sampling	ii	108 et seq.
British Columbia:		
Boundary Dist.	v	174, 376
Franklin camp	x	174
Kootenay, West	ii	75
Lardeau Dist., Fish River	vii	93
Omineca Div.	x	228
Slocan Dist.:		
Concentration, paper by FOWLER	vi	146 et seq.
"Dry ores," paper by JOHNSON	v	10 et seq.
treatment, papers by CAVERS	vii	199 et seq.
industry, 1899	iii	183
notes by WEST	iii	11 et seq.
production, 1892–1901	vi	150
values in ores	iii	171
	vi	151
	vii	372
South-eastern, notes by CORLESS	v	501 et seq.
Statistics:		
1900	iv	293, 295
1900–1	v	572
1902	vi	453
1906	x	183, 185
Telkwa River	x	222
Texada Island, Marble Bay mine	x	249
Canada:		
Statistics:		
1901	v	569
1902	vi	455
1906	x	12
New Brunswick:		
Laws respecting	vii	455

	Vol.	Page
Silver and Silver mining—Con.:		
Ontario:		
Algoma Dist.	IV	175
Cobalt Dist.	X	72
cyanidation of	IX	398
notes by MILLER	IX	14
paper by BELL	X	62–68
VAN HISE	X	44 et seq.
Recovery	X	76
Mines, notes by CARTER	VII	139–143
Occurrences, notes by MILLER	VII	381
Statistics:		
1893-1903	VII	392
1900	IV	304
1901	V	580–1
1902	VI	454
1903	VII	425, 429
Thunder Bay	X	53
United States:		
Butte, Montana	X	255
Leadville, Col.,	X	57
Nevada, Comstock lode	VI	26
Yukon:		
Conrad Mining Division, Y.T.	X	211
Windy Arm	IX	49–53
Silver Bow Creek, BUTTE, MONTANA:	X	252
Silver Cup mine, FERGUSON, LARDEAU DIST., B.C.:		
Notes by BROCK	VII	97, 98
Silver Cup Mt., LARDEAU DIST., B.C.	VII	97
Silver Islet, THUNDER BAY, ONT.:		
Graphite at	X	88
Mercury	VII	380
Silver Islet mine, THUNDER BAY, ONT.:		
Hydro-carbon gases in	X	56
Notes by CARTER	VII	139
Shaft-lining at	VII	434
Vein at	X	54
Silver King mine, NELSON, B.C., *see also* Hall Mines	V	573
Discovery	III	3
SILVER, L. P.:		
****The Sulphide Ore Bodies of the Sudbury Region***	V	528–551
Silver mill:		
Five Mile, Lardeau Dist., B.C.	VII	99
Silver Mountain, THUNDER BAY DIST., ONT.:		
Silver on	VII	140
Silverton, B.C.	V	11
Simard, A.:		
Oil-well	X	78
Similkameen Dist., B.C.:		
Coal	VI	226
Copper in	IV	229
	VIII	174, 179
Copper Mt. ore deposits, paper by SCOTT	V	493–502
Simon nickel mine (NEAR) DUMBEA, NEW CALEDONIA	VI	178

* See Summaries, page 58

	Vol.	Page
***SIMPLE AND CONVENIENT INSTRUMENT FOR MINE SURVEYS, A,** ROBBINS	IV	99–106
Simplon tunnel, SWITZERLAND:		
Paper by Meyer on driving of	II	135–142
Sillimonite-gneiss:		
Savannah, N. Carolina	IX	311
Sinking:		
LeRoi mine, Rossland, B.C., costs	V	416
Nova Scotia gold veins	II	250
Quincy copper mine	V	401
Torbrook iron mine, speed of	IX	32
Siphon pipes:		
Use of for irrigation	VII	71
†***SIR WILLIAM E. LOGAN AND THE GEOLOGICAL SURVEY OF CANADA,** BELL	X	342–370
Siwash Creek, TULAMEEN RIVER, B.C.:		
Platinum in	VIII	200
Sizing, *see also* Concentration, etc.		
Corundum	V	167
Laboratory practice in	IV	205–223
Notes by SORENSEN	VI	310
SJOSTEDT, ERNST A.:		
Discussion by, on:		
Swedish Iron Metallurgy and Its Application to Canada	II	217
The National Importance of Mining	V	140–144
Papers by:		
‡***Acid Making from Pyrrhotite***	VII	480–494
¶***A Canadian Dellwik-Fleischer Water Gas Plant***	VIII	290–301
Sjostedt roasting furnace:		
Description of	VII	484
Skeena River, SKEENA DIV., B.C.:		
Coal, analysis	X	224
notes by LEACH	X	223–8
Map	X	224
Navigation on	III	91, 92
	X	228
Paper by LEACH on the Economic Geology of	X	218–228
Skips:		
Centre Star & War Eagle mines, Rossland, B.C.	V	462
Notes by GARDE	VI	303
MACDONALD	V	342
Self-dumping device for	X	430
Skuterud cobalt mines, NORWAY	VII	406
Skutskar, SWEDEN	II	42
Slags:		
Analysis of	X	451
notes by CRAIG	VI	291, 294
Boundary Dist., B.C., analysis	VI	45
losses in	V	177
Caldecott's process of treating	IV	151
Chart	X	285
Copper Cliff, Ont.	V	546
losses in	III	226

* See Summaries, page 26
† " " 147
‡ See Summaries, page 90
¶ " " 106

	Vol.	Page
Slags—Con.:		
Disposal of (Greenwood, B.C.)	IX	356
Electric furnace, analysis	X	132
Heat in	VIII	127
Losses in	IV	226
Re-heating	IX	58
Sampling	X	446
Zinc limit in	VIII	119
Slates:		
Gold veins influenced by	II	123
Silver lead deposits in	V	514
Statistics:		
Canada, 1901	V	572
Quebec, 1900	V	350
British Columbia:		
Atlin District	V	22, 26
Boundary District	V	514
Lardeau District, Ferguson	VII	97
Poplar Creek	VII	104
Nelson District, Ymir	V	525
Rossland District	V	520
Slocan District	V	11
	VI	148
Rambler-Cariboo mine	V	11
Sandon	V	509
Whitewater mine	III	171
Vancouver Island	VI	189
Labrador Peninsula:		
Nastapoka Islands, Hudson Bay	V	256
Nova Scotia:		
Boisdale Hills, C.B.	VI	415
Gold measures	II	120 et seq.
Ontario:		
Animikie, Thunder Bay, Ont.	III	160
Nipissing Dist.	IV	276
United States:		
Marquette Range, ferruginous	II	68
Slate Creek, TULAMEEN DIST., B.C.:		
Platinum in	VIII	200
"Slate group":		
Nova Scotia gold measures	II	120
Slime, *see also* Tailing.		
Deloro, Ont., roasting	IV	144
zinc-gold	IV	144
Slocan Dist., B.C., treatment	VI	157
Smelting	IV	145
Slime mill:		
Helena Frisco mine, Idaho	IV	261
Slocan Dist., B.C.:		
Analyses of rock	II	78
Area	V	10
"Dry Ores," paper by C. JOHNSTON	V	10–14
treatment of, paper by CAVERS	VII	199–207
Dykes, relation of to ore bodies	II	83
Economic conditions, 1899-1900	III	16

	Vol.	Page
Slocan Dist., B.C.—Con.:		
Eight-hour law in, effect of	III	168
Concentration	III	20
paper by FOWLER, on coarse	VI	146–160
problems	III	170
Labour conditions, 1899	III	183
Geology	II	73
Inefficient operations in	III	13
Mining in, 1900	IV	295
Ore deposits, notes by CORLESS	V	508
continuity of	II	80
Silver-lead ores	II	76
accumulation of second class	III	14
average values in, 1898-9	III	13
profitable mining of	III	15
Statistics, 1892-1901	VI	150
Transportation in	III	16
Zinc	III	19
mining	VII	369
occurrences, notes by GWILLIM	VII	374
Slocan Lake, W. KOOTENAY, B.C.:		
Rocks	V	506
Slocan series:		
Lardeau Dist., B.C.	VII	90
Slocan Lake, B.C.	V	507
Slocan Star mine, SANDON, B.C.:		
Concentrator	VI	152
	VII	372
Vein, notes by CORLESS	V	509
***SMALL ECONOMIES IN MINING, THE,** WEST	III	11–20
Discussion on, by:		
DICK, BELL HARDMAN CAMPBELL, JOHNSTONE, FOWLER, HAY, HILL	III	170–171
Smaltite, *see also* Cobalt.		
Cobalt Dist.	X	67
origin	X	46
Silver associated with	X	71
Treatment of	VIII	360
Smelters:		
Boundary District, B.C.	V	177
Dominion Copper Co.	V	374
Grand Forks	VII	46
Greenwood, B.C., description	IX	352
Copper Cliff, Ont.	III	224
	V	546
	VII	149, 498
Northport, Wash.	V	311, 339
costs	V	341
Pictou, N.S.	IV	311
Copper Crown Co.	III	189
Rossland District, B.C.	V	311
Osborne Bay, Vancouver Island, B.C.	V	229
Wentworth, N.S.	V	584
Whitefish, Ont., Mond Nickel Co.	IV	301

* See Summaries, page 15

	Vol.	Page
Smelting, *see also* Electric Smelting.		
Bartlett-Thompson process	v	192, 212, 393
Boundary Dist., B.C.	v	174, 374
	vi	228
	x	189
costs	v	177
notes by KEFFER	vii	42–45
British Columbia, fuel supply for	vi	228
industry, 1901	iv	157
Cobalt Dist., Ont., paper by HIXON	x	74–76
Copper, *see also* Boundary and Rossland District herewith.		
Highland Boy, Utah	vi	308 et seq.
Norway	vii	402
Deloro, Ont., slimes	iv	151
Glass	viii	298
Lardeau Dist., B.C., costs	vii	101
Iron in 18th century	vi	28
Great Britain	v	132
magnetite	x	111
Ontario, notes by CARTER	vii	155
sands	vii	274
Lead	ix	58
basic ores	viii	119
Nickel:		
New Caledonia	vi	178
New York	iv	189
Sudbury Dist.,	iii	226, 229, 236
charge	v	546
Phoenix process	v	14
Records of, graphic method	x	281
Rossland Dist., B.C.	vi	228
charges for	v	311, 312, 314
Zinc:		
inaugurated in U.S.	v	136
lead	vii	275
***SMELTING OF COBALT ORES, THE,** HIXON	x	74–76
Smith Falls, ONT.:		
Water power at	iii	139
SMITH, ALEXANDER H.:		
†***"Los Reyes" Gold Mines, Southern Mexico***	viii	272–284
Smith, Daniel:		
On thawing dynamite	ii	243
SMITH, FRANK B.:		
Elected Councillor:		
1906	ix	27
1907	x	17
Papers by:		
‡***Coal Mining in the North-West Territories, and its Probable Future***	v	104–112
¶***Mining in the North-West, 1902***	vi	373–375
Views on:		
Maintaining ambulance requisites at collieries	v	111

* See Summaries, page 129
† " " 105
‡ See Summaries, page 42
¶ " " 72

	Vol.	Page
Smith, George R.:		
Address of welcome to Institute at Thetford, Que.	IV	8
Chairman, Eastern Tps. Branch of Institute	V	608
Discussion by:		
On the Nickel Deposits of New Caledonia	VI	483
The Utilization of Poor Coals and Slack	IX	330
Elected Councillor of Institute, 1898	I	18
President, 1905	VIII	34
1906	IX	26
Presidential addresses by	IX	3
	X	1–3
Views on:		
The Establishment of a Federal Dept. of Mines	IX	22
Min. refs.	VI	480
	VIII	37, 74
	IX	1, 24, 134
	X	5, 14
Smith, J.:		
Oil-well on farm of	X	77
SMITH, J, BURLEY:		
Discussions by, on:		
The Artesian and Other Deep Wells on the Island of Montreal	VIII	98, 99
Description of the Sultana Quartz Lode	II	237–243
Swedish Iron Metallurgy and its Application to Canada	II	224, 226
West Kootenay Notes	III	198
Paper by:		
**Description of the Sultana Quartz Lode, and the Sinking of the Burley Shaft in Bald Indian Bay, Lake of the Woods*	II	87 et seq.
Resolution by:		
Re Canadian Geological Survey	II	253
Smith, H. L.:		
On Marquette iron bearing district of Michigan	II	67.
Smith, Col. William Osborne	X	361
Smyth, Sir Warrington:		
on Gold mining in Nova Scotia	II	162, 163
on Loss in tailings, Nova Scotia gold mines	II	164
Shebandowan Lake, THUNDER BAY DIST., ONT.:		
Gold at, notes by BRENT	VI	331
Iron ore at	IV	281
Snider Tp., SUDBURY DIST., ONT.:		
Geological mapping of	IX	223
Nickel mining in	VII	496, 497
SNYDER, FREDERICK T.:		
Discussion by, on:		
Adjustment and Control of the Stamp Mill	II	205
The British Columbia Zinc Problem	VII	376
Elected Councillor of Institute, 1898	I	18
Papers by:		
†*The Electric Smelting of Zinc Ores*	VIII	119–131
‡*The Factors in Concentration*	III	102–109
¶*Magnetic Separation*	VII	270–277
‖*Metallurgic Standards*	II	3–12

* See Summaries, page 8
† " " 97
‡ " " 20
¶ See Summaries, page 82
‖ " " 2

	Vol.	Page
SNYDER, FREDERICK T.—Con.:		
Views on:		
The C.S.C.E. Bill, restricting engineering practice	II	256
Magnetic Separation	VII	282
Snyder magnetic concentrator	VII	278
Snow Creek, PANTHER RIVER, ALTA.:		
Coal on	X	232
Snowshoe copper mine, BOUNDARY DIST., B.C.:		
Mineralization	V	173
Ore deposit	V	368
Sooke Mts., VANCOUVER ISLAND, B.C.:		
Formation	VI	190
Sooke River, VANCOUVER ISLAND, B.C.:		
Gold discoveries	VI	189
Societa Anomina Italiano, GENOA, ITALY:		
Electro-metallurgical experiments of	V	194
Soda:		
LeBlanc process	III	135
Soda nitre:		
Saltpetre industry	VI	41
Sodium carbonate:		
Action as flux	V	42
Sohland, GERMANY:		
Nickel deposits, paper by DICKSON	IX	236–260
notes by CAMPBELL & KNIGHT	X	274–280
Solenoid electric drill	II	172
Soldering:		
Advantages of water gas for	VIII	297
Solfatara:		
Note by COSTE	VI	85
Soloviav Mt., URAL MTS., RUSSIA:		
Platinum	VIII	201
***SOLUBILITY OF COBALT NICKEL ORES IN AMMONIA,** HANES	VIII	358–362
†***SOME LABORATORY EXPERIMENTS IN MAKING STEEL DIRECTLY FROM IRON ORES WITH THE ELECTRIC FURNACE,** EVANS	IX	128–133
Discussion on, by:		
OBALSKI, SMITH, G. R., LECKIE, COSTE, PORTER, HIXON, GROVES, EVANS	IX	134–136
‡***SOME NEW POINTS IN THE GEOLOGY OF COPPER ORES.** KEMP	X	251–256
¶***SOME NOTES ON THE ECONOMIC GEOLOGY OF THE SKEENA RIVER,** LEACH	X	218–228
||***SOME OBSERVATIONS RELATIVE TO THE OCCURRENCE OF DEPOSITS OF COPPER ORE ON VANCOUVER ISLAND AND OTHER PORTIONS OF THE PACIFIC COAST,** BREWER	IX	39–48
***SOME POSSIBILITIES OF MINING IN CANADA,** HOBART.	VI	313–316
††***SOME RECENT EXPERIMENTS IN BLASTING WITH COMPRESSED CARTRIDGES,** BLAKEMORE	I	3
‡‡***SOME RECENT ROCK MOVEMENTS IN THE LAURENTIAN AND HURONIAN AREAS,** MILLS	VII	177–184

* See Summaries, page 108
† " " 116
‡ " " 142
¶ " " 139
|| See Summaries, page 109
** " " 68
†† " " 1
‡‡ " " 78

	Vol.	Page
Somerville Tp., VICTORIA CO., ONT.:		
Pyrrhotite	VII	395
Somorrostro Dist., SPAIN	IV	198
Sophie Mt., ROSSLAND DIST., B.C.:		
Formation	V	520
Limestone	V	450
Sopwith, T.:		
On gold mining in Nova Scotia	II	162
Sorcerer's Mt., CHIBOUGAMAU, QUE.:		
Iron on	VIII	366
SORENSEN, S. S.:		
***Notes on Roasting with McDougall Furnace**	VI	306–312
Soret:		
Quoted, on natural concentration	V	540
Sorting (ore), *see* Ore Dressing.		
Sorting plant:		
LeRoi mine, Rossland	V	330
Soudan formation:		
Vermilion range, Minn	VII	336
Edmonton series in	VIII	223
Souris Creek Mining Co. Ltd., SASK.:		
Coal seam and plant	V	110
Souris coalfield, SASK.:		
Coal analysis	VII	424
	VIII	237
available supply	V	112
seams	X	235
Souris, MAN.:		
Coal production, 1902	VI	454
Souris No. 1 and No. 2 coal mine, SASK.	VI	374
Souris River, CHURCHILL RIVER, SASK.:		
Coal on	X	237
analysis	V	105, 106
exposures	V	105
South Africa, *see* Africa, South.		
South Crosby Tp., *see* Crosby Tp.		
South Fork, BRIDGE RIVER DIST., B.C.	III	27
South Sherbrooke Tp., *see* Sherbrooke Tp.		
Spain:		
Bilbao Dist.:		
iron ore deposits, notes on by ADAMS	IV	196–204
Coal production, 1850-1900	VI	31
Copper industry	VI	34
Estremaderra Province:		
apatite	VI	42
Iron:		
deposits in Northern	IV	196–204
exports to Canada, 1900	V	566
production, 1899	III	120
reserves	X	141, 146
Ortuella	IV	198
Platinum used in coinage of	VIII	193
Quicksilver mining in	II	16
Rio Tinto, copper, notes by KEMP	X	254

* See Summaries, page 68

	Vol.	Page
Spain—Con.:		
San Benito iron mine	IV	202
Seville province, iron	IV	196
Somorrostro Dist.	IV	198
iron mine	IV	196
Spathic iron ore, *see also* Siderite:		
Slocan Dist., B.C.	VI	149
Spassky copper mines, SIBERIA	X	158
Specific gravity:		
Aluminium	VI	39
Cleveite	VII	245
Corundum	VII	416
determination	IV	181
Galena, Whitewater mine, Slocan Dist., B.C.	VI	156
Graphite	VI	55
	X	85
Magnesium	VI	39
Mendeleef theory	III	208
Molybdenite	VI	47
Nickel	V	550
Petroleum, crude	VIII	60
Residuum oil	VII	186
Speculator copper claim, BUTTE, MONTANA:		
Copper glance at depth in	X	252
Specular Point, LAKE WAKONICHI, QUE.	IX	20
Specular iron ore, *see also* Hematite.		
Boundary Dist., B.C.	V	369
Speculator mine, SLOCAN DIST., B.C.:		
Vein	V	12
SPELLER, F. N.:		
****Wrought Pipe-threading and Relative Durability of Steel and Iron***	VIII	46–55
Sperrylite, *see also* Platinum:		
Sudbury District:		
discovery of	VII	499
	VIII	198
Vermilion nickel mine	VII	165
	VIII	210
Wyoming	VIII	198
Rambler mine	VIII	204, 205
Sphalerite:		
Conrad, Y.T.	X	211
West Kootenay, B.C.	II	76
Spider Lake, *see* Steep Rock Lake.		
Spiegeleisen, *see also* Ferro-manganese.		
Hydrocarbons from	VI	124
Spindletop, BEAUMONT, TEXAS, U.S.A.:		
Oil at	VI	90, 92, 114
Spinel:		
Burgess, Ont.	VII	412
Spitzee mine, ROSSLAND, B.C.:		
Production, 1894-1904	VII	47
Spokane Mt., ROSSLAND DIST., B.C.:		
Formation	V	520

* See Summaries, page 93

	Vol.	Page
Springer Creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11
Mines on	V	12
Springhill, CUMBERLAND COUNTY, N.S.:		
Coal mining, 1901	V	582
Spruce:		
Boundary Dist., B.C.	V	426
for Charcoal	II	46
Sudbury Dist., Ont.	VII	495
Spruce Creek, ATLIN DIST., B.C.:		
Cross-section	V	25
Gold production, 1900-1901	V	32
Notes on by GWILLIM	V	21, 22
Placer mining	III	99
Spurr, J. E.:		
Quoted on:		
Genetic relation of igneous rocks to ore occurrences	VII	233
Goldfield, Nevada formation	VIII	40
Origin Yukon quartz veins	VII	234
Spy glass mineral claim, POPLAR CREEK DIST., B.C.	VII	102, 105
Stage compression:		
Notes by SAUNDERS	V	157
Stairs, E. G.:		
Discussion by, on:		
The Need of a Provincial Museum in Ontario	VIII	73
Staking, (mineral claims):		
Ontario	III	111, 112
Stamp mills and milling, *see also* Amalgamation, Concentration, Ore dressing.		
Bolton feed, disadvantages of	II	233–234
Canadian trade in, 1900	IV	315
Concentrating problem, minimum limit	III	103
Control of	II	205–207
Costs, how chargeable in accounting	III	49
classification	III	52, 53
considerations	III	103, 104
Crushing with, notes by PORTER	IV	214
dry	II	104
for high capacity	IV	191
"Cupping," prevention of	II	156
DEKALB, notes by	IV	190–195
	IX	64–71
Design, tests to determine	II	149
of mortar	II	150, 151
Discharge, change of	II	161
height	II	5, 153
Drop, change of	II	150, 161
height of	II	5, 153
Feed, regulation of	IV	115
water	II	54
Free gold ores	IV	192
Pulp residues	IV	193
Sectional	IV	190
Silver-lead ores, B.C.	VII	100

	Vol.	Page
Stamp mills and milling—Con.:		
Stamps, duty of	IX	66
high speed	IV	119
height of drop	II	5, 153
order of drop	II	155
speed	IV	194
vs. momentum	II	152
weight of	II	149, 152
		206
British Columbia:		
Lardeau Dist., Eva mine, Fish River	VII	96
Five mile	VII	99, 100
Nelson Dist., Athabasca	IV	83, 85
Ymir	III	8
Mexico:		
Los Reyes	VIII	281
Nova Scotia:		
Dufferin mine	II	102
North Brookfield	II	164
	VII	308
Oldham-Sterling	X	434
Waverley	II	234, 236
Ontario:		
Belmont mine	V	241
Deloro mine	IV	114 et seq.
	V	241
Eastern	V	241
Rainy River Dist.	VII	132
Statistics, 1903	VII	132
Sultana mine	II	87
United States:		
California	II	232
	IV	191
Mountain Lion mine, Wash	V	276, 278
South Carolina	II	232, 236
Stacker:		
Gold dredge	V	93
Standardization:		
Institute committee appointed on	X	18
Iron, notes by CRAIG	VI	295
Metallurgical machinery	II	28
paper by SNYDER	II	3–12
Solutions	X	458
STANSFIELD, DR. ALFRED:		
Discussion by, on:		
Electric Smelting	VIII	155, 156
Papers by:		
The Electrothermic Production of Steel from Iron Ore	X	129–133

* See Summaries, page 133

	Vol.	Page
STANSFIELD, DR. ALFRED—Con.:		
Papers by—Con.:		
**The Teaching of Metallurgy in College Laboratories, with a Description of the Metallurgical Laboratories of McGill University*	IX	180–191
Min. ref.	IX	152
Star of the East Gold mine, BARRIE TP., ONT.:		
Ore occurrence at, notes by KNIGHT	VII	210
		235 et seq.
Star Gold Dredging Co.	IV	297
Star Mountain, SANDON, B.C.:		
Silver-lead vein	V	509
Stassano, Capt.:		
Electric smelting experiments of	X	129
Min. ref.	VIII	133
Stassano electric process:		
Description of	VIII	150
Statistics, *see also* Mineral Production.		
Aluminium	VI	68
British Columbia, 1901, notes by KIRBY	VI	357
in Canada, uniform presentation of, paper by COSTE	VIII	169–171
1902	VI	453 455,
Coal, world's production, 1850-1900	VI	31
Compiling, methods of	VIII	164
notes by COSTE	VIII	168
and use, paper by HOBART	VIII	162–167
Diagrammatic presentation of, notes by WHITE	VI	323
Feldspar, Ontario, 1900-1903	VII	166
Ferro-molybdenum	VI	64
Gold, in XIXth century	VI	25
Graphite	X	99
Indigo	V	145
Iron and steel, world's production, 1807-1900	VI	29
Mica, Ontario, 1899-1903	VII	162
Nickel	VI	69
Platinum	VIII	194–196
†***STATUS OF THE MINING PROFESSION, THE,*** GWILLIM	X	321–327
Discussion on, by:		
LEDOUX, COSTE, PORTER, MILLS, CURRIE, JACOBS, GOODWIN, LORING	X	328–339
Staurolite:		
Ymir, B.C.	V	525
Steam:		
Air compressing by, paper by THOMPSON	VI	180–187
Coals, relative values in producing	IX	323
in Mine pumping	III	197
Pressure, heat required to maintain	VII	507
Yukon gold mining, thawing by	V	575
Steam coal, *see* Coal.		
Steam engine:		
Efficiency	VIII	124
Iron industry affected by	VI	28
Gold-dredging	V	92

* See Summaries, page 117

† " " 146

	Vol.	Page
Steam pipes:		
Cross section of box enclosing	v	480
Insulation	v	470
Steam ploughs:		
Notes by WILLIAMS	viii	66
Steam shovels:		
Chicago drainage channel, operation and costs	iii	33
Copper mines, Boundary Dist., B.C.	v	177
Steam transmission:		
Rossland, B.C., LeRoi mine	v	470
War Eagle mine	v	469, 480
Steaming tests:		
U. S. Geological Survey, on coals	ix	322 et seq.
Steel:		
Annealing	viii	297, 298
Atikokan, Ontario, iron ore	v	58
Basic open-hearth process, paper by LATHE	x	373 et seq.
Bessemer process	v	221
Bicycle tubing	ii	52
Bursting tests on pipe made from	viii	53, 54
Charcoal iron in open hearth	ii	51
Chrome, from Canadian ores	ii	26
Crusher, castings of	ii	33
Corrosion of, paper by SPELLER	viii	46–58
Diamonds in chilled	iii	196
Electric furnace, analysis	x	132
Electric production:		
notes by HAANEL	viii	144 et seq.
paper by EVANS	ix	128–142
STANSFIELD	x	129–133
Industry:		
Canada, bounty, 1900	iv	313
Nova Scotia, 1902	vi	448
Ontario, Sault Ste. Marie	iii	195
Russia	iv	25
Sweden	ii	41, 215
		216, 218
Finspong	ii	52
Kopperberg	ii	42
rails	ii	44
Sandvik	ii	52
United States	iv	24
notes by BIRKINBINE	v	221
Manganese in	v	38
Molybdenum	vi	62
Oriental markets for	iv	25
Pipe made from	viii	52
Rails, manganese for	x	394
Sault Ste. Marie, Ont.	iii	195
Reinforcing concrete with	viii	109
Shaft "timbering" with	vii	352, 356
Shoes and dies	iv	85
Statistics:		
Canada, 1898	ii	220
1900	iv	313
1901	v	566 et seq.
1902	vi	454, 455

	Vol.	Page
Steel—Con.:		
Statistics—Con.:		
Nova Scotia, 1901	V	583
1902	VI	448, 453
Steel Co., 1900	IV	311
Ontario, 1901	V	581
1902	V	464, 465
		466
1903	VII	391, 425
		429
1905	IX	14
open hearth, 1900	IV	304
world, 1807-1900	VI	29
Tempering	VIII	297, 298
"Toledo"	IV	197
Wire rope	IV	44
breaking strain of	V	35
Wood-gas in manufacture of	V	178-182
Steel works:		
Nova Scotia Steel Co., description	IV	35
Sydney, C.B., description	IV	12–13
Steep Rock, ATIKOKAN IRON RANGE, ONT.	VII	257
Steep Rock Lake, SEINE RIVER, ONT.:		
Formation at	VIII	184
Limonite	V	55
Pyrites at	VII	158, 386
Stellarton coalfield, N.S.:		
Sketch section of geological formations	V	363
Stellarton formation:		
Geological section	V	361, 363
Pictou coalfield	V	358
Stemwinder mine, BOUNDARY DIST., B.C.:		
Gold values	V	373
Stephanite, *see also* Silver.		
Yukon, Conrad	X	211
Windy Arm	IX	51
Stephens, Barclay:		
Death of	IV	288
Stephens, Sir George	VII	496
Stevenson, A. W.:		
Election as Treasurer, C.M.I., 1898	I	18
1899	II	252
Resolution by, on:		
Grant to Geological Survey	II	253
Views on:		
Establishment of Bureau of Mines in Montreal	VI	482
Vote of thanks to	III	220
Min. ref.	VI	481
	VII	21
	VIII	9
Stevenson safety lamp	V	380
Stevenstown copper claim, PRINCE OF WALES IS., ALASKA	X	202
Stewart granite works, HAMILTON, ONT.:		
Exhibit, Buffalo Exposition	V	254
***STEWART RIVER GOLD DREDGE, THE,** ROBINSON	VI	214–223
Discussion on, by:		
HARDMAN, ROBINSON, LECKIE, ERRINGTON	VI	469–470

* See Summaries, page 65

	Vol.	Page
Stibnite, *see also* Antimony.		
Conrad, Y.T.	x	211
West Kootenay, B.C.	ii	75
Wheaton River, Y.T.	x	214
"Stigmaria":		
Boisdale Hills, C.B.	vi	417
Stobie, James	vii	497
Stobie nickel mine, COPPER CLIFF, SUDBURY DIST., ONT.:		
Discovery of	vii	497
Note by CARTER	vii	149
Ores of	vii	498
STOCKETT, LEWIS (and WARDEN, B. R.):		
Anthracite Breaker of the Pacific Coal Company, Limited, Bankhead, Alberta	ix	261–271
Stoek, H. H.:		
Min. ref.	x	15
Stoke Mt., RICHMOND CO., QUE.:		
Rocks on	vii	399
Trap rocks	v	85
Stoke Tp., RICHMOND CO., QUE.:		
Copper bearing rocks of	viii	260
Stokes safety lamp:		
Merits of	vi	206
Stone:		
Concrete making with	viii	107
Stoness mica mine, LOUGHBORO TP., ONT.:		
Depth of	vii	163
Stonier, George S.:		
Ref. to report by on Ceylon graphite	x	87
Stopes and stoping:		
Boundary Dist., B.C.:		
Mother Lode mine, methods and plan	v	214
Knob-Hill-Ironsides	v	367, 424, 432, 434
Butte, Montana, value of ore in at depth	x	254
Costs of, how chargeable in mine accounting	iii	61
Rossland Dist.	v	340, 477
Mica mines, methods	vii	299
Quincy copper mine, Mich.	x	405
Rossland Dist.	vi	130, 135
Le Roi mine	v	315, 410
War Eagle-Centre Star mine	v	477
Sudbury nickel mines	v	542
Surveying	viii	324
Timbering:		
Boundary Dist.	v	432
Rossland Dist.	v	315
Ymir mine, B.C.	iii	8
Storrington Tp., FRONTENAC CO., ONT.:		
Mica	vii	289
Stoverntangen nickel mines, NORWAY	vii	406
Strains:		
Graphic method of analyzing	ii	30
Strait of Georgia glacier	x	244
Strata:		
Impermeability of, in oil regions	vi	116
Stratford, S. EASTHOPE TP., PERTH CO., ONT.:		
Oil wells	ii	208

* See Summaries, page 121

	Vol.	Page
Stratified rocks:		
Ontario, mineral yield from	VII	170
Stratigraphy:		
Cascade Coal Basin, paper by DOWLING	VIII	221, 233
Study of, notes by PARKS	VII	16, 168
***STRATIGRAPHY OF THE CASCADE COAL BASIN, THE**		
DOWLING	VIII	221–233
Discussion on, by:		
COSTE, DOWLING, WHITE	VIII	233–234
Strawhat Lake, RAINY RIVER DIV., ONT.:		
Pyrite deposit at	X	124
Straw Hat Lake, near STEEP ROCK LAKE, R. R. DIV., ONT.:		
Pyrites at	VII	158
	X	124
Stream-measurement:		
Notes by WHITE	VI	322
Stress, *see also* Tensile Strain.		
Wire rope	V	40
Stretch, R. H.:		
Report on Whitehorse copper deposits, referred to	X	214
Strikes:		
Arbitration for settlement of, Fergie's views on	VI	450
of Coal miners in U.S., effect on Canadian market	VI	450
Stromeyerite:		
West Kootenay, B.C.	II	76
Strontianite:		
Uses and occurrence	VI	44
Structural material:		
Statistical notes on U. S. and Canadian production by JOHNSON	VI	70
Struthers, Dr. Joseph:		
Quoted on platinum production	VIII	194
Students, (MINING):		
Work for on Geological Survey	VII	444, 445
Students' competitions, *see* Canadian Mining Institute.		
†***STUDY OF STRATIGRAPHY, THE,*** PARKS	VII	168–174
Discussion on, by:		
CRAIG, PARKS, MILLER, INGALL	VII	174–176
Sturgeon Lake, R. R. & THUNDER BAY DIV., ONT.:		
Gold at	VII	124
alluvial	VIII	381
Sturt Bay, TEXADA ISLAND, B.C.:		
Copper near	X	245
Stuart, G. W.:		
Discussion by, on:		
Adjustment and Control of the Stamp Mill	II	205
The Gold Measures of Nova Scotia and Deep Mining	II	245, 248
An Improved Method of Feeding Water to the Stamp Mill Mortar	II	234, 236
Notes by, on gold mining in Nova Scotia	IV	44–48
Sudbury Dist., ONT.:		
Hematite	IV	208
Anthraxolite	VII	253
Carbonaceous slates	X	55, 56
Early history of mining in, paper by EVANS	VII	495–499

* See Summaries, page 102

† " " 78

	Vol.	Page
Sudbury Dist., ONT.—Con.:		
Geology:		
note by MILLER	VII	183
paper by HIXON	IX	223–227
Magnetic surveying	V	377
Nickel in	IV	184
deposits, genesis	IV	270
notes by COLEMAN	X	309
DICKSON	IX	257
notes by COLEMAN	VII	59
MILLER	V	235 et seq.
paper by HIXON	IX	223–227
SILVER	V	528–551
industry	V	121
beginning of	III	224
mines, notes by CARTER	VII	148
mining, note by MILLER	VI	38
ores, concentration	VII	279, 282
production, 1900	IV	301
1901	V	569, 579
1903	VII	425
1905	IX	14
Platinum in	VIII	198, 199 203
notes by GIBSON	VIII	211, 212
Pyrrhotite, nickeliferous, microstructure of	X	274–280
origin, notes by BARLOW	VII	63
Sulphuric acid manufacture in	VII	480
Tin in	VII	380
Subsidies:		
Crow's Nest Pass Coal Co.	IV	237
Suffield, ASCOT TP., SHERBROOKE CO., QUE.:		
Copper mine	V	82
Formation at	VIII	260
"Suffionis":		
Notes by COSTE	VI	85, 86, 89
Sugar plantations:		
Hawaiian Islands, water supply for	VII	70–81
***SUGGESTED IMPROVEMENTS TO THE MINING LAWS IN CANADA,** COSTE	VII	450–466
Discussion on, by:		
LECKIE, THOMPSON, CLARK, HARDMAN, O'CONNOR, GIBSON, COSTE, WALSH, BLUM, CRAIG	VII	466–477
Suhr, O. B.:		
Experiments by with concrete	VIII	104, 107
Sulitjelma copper mines, NORWAY	VII	402
Sullivan silver-lead mine, FORT STEELE DIV., B.C.	V	511
Sulphate of baryta, *see also* Baryte(s).		
Production, Quebec, 1900	V	350
†***SULPHIDE ORE BODIES OF THE SUDBURY REGION, THE,** SILVER	V	528–551
Sulphides:		
Athabasca mine, Nelson, B.C.	IV	83
Atlin, B.C.	III	99
Blezard, Ont.	III	225
Boundary Dist., B.C., copper-bearing	V	367

* See Summaries, page 89
† " " 58

	Vol.	Page
Sulphides—Con.:		
Bridge River Dist., B.C.	III	27
Concentration practice	III	107
Copper, leaching and electrolysis of copper	V	197
Mt. Morgan, Queensland	X	255
Yerington, Nevada	X	259
Nickel	IV	184
Nickeliferous pyrrhotites, order of	X	279
Rossland, B.C.	II	76
	V	451
proportion of in ores	VII	51
Slocan Dist., B.C., antimony	V	12
Sudbury Dist., relations of	X	275
Treatment of, copper	V	197
paper by JACKES	VIII	244–258
in stamp-mills	IX	71
zinc-iron	VII	275
West Kootenay, origin	II	77
Sulphite pulp works:		
Sault Ste Marie, Ont.	VII	158
Sulphur:		
Boundary Dist., B.C.	V	174
Calorific power	IV	135
Coal, Crowsnest Pass, B.C.	IV	236
Determination of	X	449
Eustis mine, Que.	VII	400
Industry, notes by JOHNSON	VI	71
Iron:		
Canadian	II	225
elimination of	VI	12
	X	131
pig, test for	VI	292
separation of	VII	272
Ontario pyrrhotite deposits	VII	396
Petroleum	VI	100
as hydrogen sulphide	III	87
Tilbury, Ont.	X	80
Reduction of, Highland Boy smelter, Utah	VI	309
Steel:		
effect of	V	38
manufacture, removal of	V	395
Sudbury Dist., Ont.	V	236
Utilization of	VII	481
Sulphur Creek, KLONDIKE, Y.T.:		
Gold royalties, 1900	IV	196
Note by COSTE	III	210
MCCONNELL	III	124
Sulphuretted hydrogen:		
in Illuminating gas, presence of	X	78
Petroleum	VI	100
Sulphuric acid:		
Bromo cyanide process	IV	150
Canadian importation, notes by GOODWIN	V	148
Eastern Tps., Que.	V	85
Manufacture of:		
paper by MEISSNER	VI	390–407
from Pyrrhotite	VII	480–494
Sudbury District	VII	490, 492
Notes by MILLER	V	250

	Vol.	Page
Sulphurous acid:		
Manufacture of, Sault Ste. Marie, Ont.	VII	158
How obtained	IV	124
Solvent of copper	IV	123
Sulphurous anhydride:		
Manufacture of	VII	481
Sultana gold mine, LAKE OF THE WOODS, ONT.:		
Equipment and production, notes by CARTER	VII	132, 133
Map	II	93
Notes by BRENT	VI	332
Paper by J. BURLEY SMITH	II	87, 101
Sumatra:		
Platinum occurrence in	VIII	202
Summit Creek, W. KOOTENAY, B.C.:		
Rocks	V	506
Sun:		
Life of, notes by HIXON	X	301
Spots	X	306
Sunbeam gold mine, ISLAND FALLS, SEINE RIVER, ONT.	VII	138
Sunrise mine, COPPER MT., SIMILKAMEEN DIST., B.C.:		
Notes by SCOTT	V	494
Sunset mine, COPPER MT., SIMILKAMEEN DIST., B.C.:		
Map	V	495
Notes by SCOTT	V	493
Sunshine, COL., U.S.A.:		
Coal analysis	IV	235
SUPPLIES AND RESERVES OF IRON ORES, THE, BIRKINBINE	X	134, 148
Surprise mine, TEXADA ISLAND, B.C.	X	244
Suquash, VANCOUVER ISLAND, B.C.:		
Coal mining	VI	188
Surveying, *see also* Geological and Mine Surveying.		
Drill holes	IX	394
Brayton Domain colliery, England	IX	410
Coal Creek colliery, B.C.	IV	168
McGill University, teaching	V	5
Ore deposits, magnetic	V	377
Topographic	IX	80
Surveying instruments:		
Extension tripod	IV	105
Gurley compass	IV	101
Robbins' appliance for use in mines	IV	101–106
Susquehanna Coal Co., NANTICOKE, PA.:		
Compressed air haulage	IV	42
Paper on coal mine of, by WINTER	IX	375–386
Sutter Creek, CAL.:		
Drilling costs at	IX	389
Sutton Mts., BROME CO., QUE.:		
Copper-bearing rocks	VIII	260
Sutton mineral belt, EASTERN TPS., QUE.	V	81
Svartnas, SWEDEN.		
Iron works	II	43
Svarto iron mine, SWEDEN.		
Magnetic concentration	IV	16
Swappavaara, SWEDEN.		
Iron ore deposit	II	38

* See Summaries, page 133

	Vol.	Page
Sweden:		
Area	II	45
Ag, iron works	II	44
Dala River	II	43
Dalecarlia Province	II	42
Dannemova, magnetic concentration	VI	17
Domnarfvet	II	41
iron exports	II	44
works	II	43
manufactures of	II	44
Forestry	II	218
conservation	VII	47
Gellivare, iron concentration at	X	267, 270
ore deposit	II	38
Grangesberg, magnetic concentration	VI	17
Graphite statistics	X	101, 102
Gysinge, electric manufacture of steel	VIII	144
Herrang, concentration of iron ores	X	261, 270
Hjuljern	VI	17
Iron:		
analysis	II	218
concentration	VI	16, 17
	X	262
deposits	II	214
industry	II	213–216
production, 1879	II	41
1899	III	120
reserves	X	141, 146
and steel industry, 1897	II	41
production, 1807-1900	VI	29
Kiirunavaara, iron ore deposit	II	48
resources	II	39
Kopparberg, charcoal consumption	II	45
Kopparberg Company, inception of	II	43
mines and properties of	II	42
production, charcoal kilns	II	51
Korsa, iron works	II	44
Lake Luossajarvim, iron resources of	II	39
Luassavaara, iron ore deposit	II	38, 214
Lulea	II	38
	VI	17
Lumbering and wood pulp manufacture	II	42
Sandvik, steel works	II	52
Steel industry, 1898	II	41
production, 1833-1887	II	41
SWEDISH IRON METALLURGY AND ITS APPLICATION TO CANADA, DOUGLAS	II	38–53, 212–216
Discussion on, by: SJOSTEDT, DRUMMOND, G. E., MILLER, BRAINERD, DOUGLAS, SMITH, J. B. COSTE, INGALLS	II	217–226
Switzerland:		
Simplon tunnel	II	137
Swinging Hills, LARDER LAKE, ONT.	X	69

* See Summaries, page 5

	Vol.	Page
Sydney, N. S.:		
Excursion of Institute to	IV	11
Projected iron works at	II	59
Sulphuric acid manufacture at	VI	390–407
Steel manufacture at	X	373
Sydney Coal Co., SYDNEY, N.S.:		
Production, 1901	V	583
Sydney Inlet, VANCOUVER ISLAND, B.C.:		
Copper ores	VI	198
	X	196
bornite	VIII	174, 178
	IX	40
Sydenham, Lord	IX	87, 88
Syenite:		
Boisdale Hills, C.B.	V	421, 429
Franklin Camp, B.C.	X	172
Ontario:		
Corundum occurrences	III	200
	VII	418, 419
Eastern	III	200
Gladstone Tp., Alg.	VII	180
Peterborough Co.	VII	305
Rossland Dist., B.C.	V	519
Platinum in	VIII	201
Syenite-porphyry:		
Boundary Dist., B.C.	V	367
Sylva, N. CAROLINA, U.S.A.	IX	303
Sylvanite, *see also* Tellurides.		
Thunder Bay Dist., Ont.	VI	334
Wheaton River, Y.T.	X	214

T

Taber Coal Co., TABER, ALTA.:		
Coal, quality of	X	234
Taché Tp., RIMOUSKI CO., QUE.:		
Rare minerals found in	IX	73
Tacoma Steel Company:		
Marble Bay mine purchased by	X	245
Tagil River, RUSSIA:		
Platinum in	VIII	196
Tagish Lake, Y.T.:		
Silver at	IX	49
Tailing:		
Arrastra, retreatment of	VIII	283
Belmont mine, Ont., screen analysis	II	8, 11
Boerth gold mine, Ont.	VII	244
Broken Hill, N.S.W., values in	VIII	161
Deloro mill, Ont., notes by WRIGHT	IV	143 et seq
Diamonds in	III	151
Graphite	X	93

	Vol.	Page
Tailing—Con.:		
Helena-Frisco mill, Idaho	IV	261
Los Reyes, Mexico	VIII	275
Losses in	II	144, 164
Molybdenite	VI	53
Sampling	IV	120
Slocan Dist., B.C.	VI	156
Smelting	IV	145
Taku Arm, Y.T.	X	213
Talc:		
Hastings County, Ont.	VII	167
Madoc, Ont.	V	245
Ontario production, 1902	VI	464, 465
1903	VII	392, 430
Tally-ho Mining Co., WHEATON RIVER, Y.T.:		
Quartz on mines of	X	214
Talon, Intendant	IX	4
Taman, CAUCASUS MTS., RUSSIA:		
Mud volcano	VI	86
Tamarac (TAMARACK OR HACMATACK):		
Boundary District, B.C.	V	426
Sudbury District, Ont.	VII	495
Tamaulipas, MEXICO:		
Asphalt deposits	VI	89
Tamworth, SHEFFIELD TP., ADDINGTON CO., ONT.:		
Molybdenite deposit	VII	164
Tangys compressed air pump	IX	404
Tanks:		
in Bromo-cyanide process	IV	144
Precipitating, for copper	IV	124
Tantalum:		
Australia	X	65
Tantalus coal mine, YUKON RIVER, Y.T.:		
Coal analysis	X	217
Notes by CAIRNES	X	216
Section	X	217
Tappet:		
Power drills, notes by HANSEN	V	489
Tar, *see also* Coal-tar, Gas-tar, etc.		
Production, by-product ovens, Everett, Mass.	IV	11
Tar Point, GASPÉ CO., QUE.:		
Note by R. BELL	VI	127
Rocks at	VI	77
Tariff(s):		
Iron, BEST'S views on	V	230
Mining machinery	VI	369
Scientific apparatus, MCAREE'S views	V	138
SJOSTEDT'S views	V	142
Tatla Lake, ATLIN DIST., B.C.	III	94
Taxation and Taxes, *see also* Mining Taxation, Ontario Government, Royalties, etc.		
Australasia	X	336
British Columbia	VI	357
amount collected, 1901	VI	557
crown granted mineral claims	VII	467
metal mines	V	319, 320
resolution of Provincial Mining Association	VII	459

	Vol.	Page
Taylor,, C. H.:		
Discussion by, on:		
The Artesian and Other Deep Wells on the Island of Montreal	VIII	99
Taylor, John, Jr.:		
Report by on Bruce mines	X	153
Taylor, John & Sons:		
Bruce mines acquired by	X	151
Taylor, Capt. H.:		
Experiments by with concrete	VIII	107
TEACHING OF METALLURGY IN COLLEGE LABORATORIES WITH A DESCRIPTION OF THE METALLURGICAL LABORATORIES OF McGILL UNIVERSITY, THE, STANSFIELD	IX	180–191
Technical education:		
Camborne School of Mines	V	5
Germany, teaching staffs	V	147
Government promotion, GOODWIN'S views	V	144
HOLDICH, paper by	II	21
McAREE'S views	V	138
McGill University, mining	V	4 et seq.
SJOSTEDT'S views	V	143
Technical investigation:		
By Government, notes by HARDMAN	V	121
Technical schools:		
Germany, state aids to	V	146
"Göthingen"	V	147
Tehuantepec Isthmus, MEXICO	VIII	272
Telemarken series:		
Norway	VII	401
Telkwa Mining, Milling and Development Co., GOAT CREEK, SKEENA DIV., B.C.	X	224, 226
Telkwa River, SKEENA RIVER, B.C.:		
Coal, discovery of	X	223
Copper occurrences on	X	221
Granite rocks on	X	221
Telkwa River coalfield, B.C.:		
Report on by LEACH	X	225
Telluride(s):		
Gold Hill, Conrad Div., Y.T.	X	213
Thunder Bay Dist., Ont.	VI	334
West Kootenay, B.C.	II	76
Temiscaming, *see* Timiskaming.		
Temiskaming and Northern Ontario R'ly.:		
Cobalt discoveries due to	VII	142
Gypsum deposits on line of	VII	166
Proposed construction of	IV	279
Temperature:		
Air-compression	V	157
	VI	244
Assaying	IV	227
Fumaroles	VI	84
Gas explosions, effect of	VI	205
Melting points of metals	V	7
Open-hearth furnace	X	375
control of	X	392

* See Summaries, page 117

	Vol.	Page
Temperature—Con.:		
Refrigerating air in deep workings	II	142
St. Gothard tunnel, Switzerland	II	142
SORET'S experiments	V	540
Tempering:		
Water-gas for	VIII	297
Templeman, Hon. Wm.:		
Appointed Minister of Mines	X	5
Templeton Dist., OTTAWA COUNTY, QUE.:		
Feldspar	II	64
Mica	IV	305
Ten Mile, INDIAN TERRITORY, U.S.A.	VI	105
Ten Mile, LARDEAU DIST., B.C.	VII	87
Ten Mile Creek, NICOLA DIST., B.C.:		
Copper on	VIII	174
Ten Mile Creek, SLOCAN DIST., B.C.:		
Dry ores of	V	11
Tenderfoot Creek, LARDEAU DIST., B.C.	VII	93
Tenderloin Creek, LARDEAU DIST., B.C.	VII	110
Tenderloin Mt., FRANKLIN CAMP, B.C.:		
Copper lodes on	X	175
Tennantite:		
West Kootenay, B.C.	II	76
Tennessee, U.S.A.:		
Phosphate	IV	75
Tensile strain:		
Wire rope	V	35, 40
Tensile strength:		
Portland cement	VIII	103
"Terebratula":		
Boisdale Hills, C.B.	VI	416, 427
Termier, Prof.:		
Work by on eruption of Hartz region	VI	76
Terra cotta:		
Ontario production, 1900	IV	304
Tertiary:		
Alberta	VIII	221
Boundary Dist., B.C.	V	367, 369
Franklin Camp, B.C.	X	172
Goldfield, Nevada	VIII	40
Skeena Riv. Div., B.C.	X	223
Vancouver Island, B.C.	VI	189
West Kootenay, B.C.	II	77
Teslin Lake, B.C.	III	97
***TEST OF A TWO-STAGE COMPRESSOR,** PRESTON	II	130
Tests:		
Air compression, Rossland, B.C.	VI	185
compressor plant, Caledonia colliery, C.B.	II	130
Cast iron, methods	IV	41–22
Cement	VIII	104–107
Clanny safety lamp	V	384 et seq.
Coal gas, combustion	IV	139
in gas producer	IX	322
steam and gas	IX	321, 322
washing	IX	329

* See Summaries, page 11

	Vol.	Page
Tests—Con.		
Coking, anthracite dust	IX	327
Concentration	III	104, 107
Corundum	III	200
determination	IV	181
Cyaniding, rate of gold soluble	VIII	47
Cobalt Dist	IX	398
for Fire damp	VI	213
Iron:		
briquette, Atikokan, Ont	V	58
cast, methods	IV	41–42
corrosion	VIII	47
titaniferous in blast furnace	IV	270
Leaching copper ores	IV	125
Magnetic separation, McGill University	V	8 et seq.
Milling:		
Bridge River, B.C.	III	27
Camp McKinney, B.C.	II	144
gold ores	II	160
Mine pumping	III	128
Molybdenite ores, concentration of	VI	51 et seq.
Pumps	VII	79
Roasting, pyrrhotite	VII	487
Safety lamps	V	383, 385
		388, 390
Steel corrosion	VIII	47
Wire rope	IV	42
	V	37, 41
Tetradymite:		
West Kootenay, B.C.	II	75
Tetrahedrite: *see also* Copper.		
Argentiferous	II	76
Attraction of, for oil	VII	187
Boundary Dist., B.C.	V	369, 376
Conrad, Y. T.	X	211
Fish River, Lardeau Dist., B.C.	VII	93, 97, 98
		99
Platinum occurring with	VIII	198
Poplar Creek Dist., B.C.	VII	106, 109
		112
Slocan, B.C.	II	76
Slocan Star mine	V	509
West Kootenay, B.C.	II	76
Windy Arm, Y.T.	IX	51
Texada Island, B.C.:		
Copper ores	X	196
(bornite)	VIII	172
	IX	40
notes by CAIRNES	X	215
Geology of	X	243
Gold quartz	VIII	180
Texas, PENNSYLVANIA, U.S.A.:		
Genthite analyses	IX	307
Oilfields, evidences of vulcanism	VI	89
Thawing house:		
LeRoi mine, Rossland	V	338

	Vol.	Page
Thermal springs:		
Action on rocks	II	78
Solfataric action	II	84
West Kootenay, B.C., composition	II	79
Thetford Dist., QUE.:		
Asbestos	II	64
analysis	V	346
operating methods	IV	7–8
production, 1900	IV	305
Excursion of C.M.I. to	IV	7
Thomas iron process:		
Invention of	VI	29
Thompson, John L.:		
Forehearth devised by	IX	59
Thompson, Robert M.	IV	184
THOMPSON, WILLIAM:		
Assistant manager, LeRoi mine	V	342
Discussion by, on:		
The Exploration of Ontario's Iron Range	VII	269
Influence of Government on Mining	VI	365, 369
The Ore Deposits of Rossland Dist., B.C.	VII	61, 69
Solution of Gold in Potassium Cyanide	VII	194
Suggested Improvements to the Mining Laws of Canada	VII	466, 478
Notes on cement in mine construction work	VII	432, 433
Papers by, on:		
**Comparison of Costs of Compressing Air with Steam and Electricity at Rossland, B.C.*	VI	180–187
†*Mine Signalling by Compressed Air*	VI	161–168
‡*Notes on the Construction of Mine Bulkheads*	VII	82–86
Min. refs.	VII	58
Thomson recording wattmeter	VIII	142
Thorium:		
Price and use, note by MILLER	VI	43
Thorne coal mine, MOOSE MT., ALTA.:		
Coal hardness	X	232
seam	X	232
Threading tools:		
Notes by SPELLER	VIII	53
Three Forks, SLOCAN DIST., B.C.:		
Railway construction to	VI	147
Three Rivers, CHAMPLAIN CO., QUEBEC:		
Ochre	II	62
	III	187
Three Sisters Peaks, ROCKY MTS., ALTA.:	VIII	226
Thunder Bay Dist., LAKE SUPERIOR, ONT.:		
Gabbro in	IX	291, 293
Iron formation	VI	254
Magnetite	IV	281
Mesabi rocks at	VI	462
Notes on geology and gold ores by BRENT	VI	327 et seq.
Pyrite deposits	X	123
Silver discovery at	VII	139
Silver in, notes by INGALL	X	53
Thunder Bay silver mine, THUNDER BAY, ONT.	VII	139

* See Summaries, page 64
† " " 63
‡ See Summaries, page 76

	Vol.	Page
Thunder Cape, ONT.:		
Possibilities of finding diamonds at	III	160
Thurston, Prof. R. H.:		
Quoted on corrosion of iron and steel	VIII	47
Min. refs.	II	33
	X	97
Tichenor, J. F.	IX	332
Ticonderoga, N.Y.:		
Graphite analysis	X	95
Tiger-Poorman mine, IDAHO, U.S.A.	IV	255
Tilbury oilfield, KENT COUNTY, ONT.:		
Paper by COSTE on geology of and operations in	X	77
Tile(s):		
Ontario production, 1902	VI	464
1903	VII	430
Tilghman:		
Pulp-making process	VII	488
Tilkerode, HARZ MTS., GERMANY:		
Platinum occurrence	VIII	198
Tilt Cove, NFLD.	VI	391
Timagami Dist., ONT.:		
Pyrite at	X	124
Iron range	VII	257
notes by BARLOW	VII	266, 396
Silver discovered at	VII	142
Timagami Lake, ONT.:		
Brecciated rocks at	X	64
Iron ores, notes by CARTER	VII	154
origin of	VII	159
Timber:		
Atlin Dist., B.C.	III	101
Boundary Dist., B.C., character of	V	426
Bridge River Dist., B.C.	III	23
Chibougamau Dist., Que.	VIII	366
Crowsnest Pass, B.C.	IV	234
Douglas County, Oregon	IV	185
Northwest Territories	V	105
Nova Scotia, price of mine	IV	45
Ontario:		
Chestnut	IV	265
Sudbury Dist.	VII	495
Rossland Dist.:		
framing	V	337
sawing, costs	V	472
Sill-floors	VI	131
Timber bulkhead:		
Centre Star mine, Rossland, B.C.	V	457
Timber reserves:		
Ontario, mineral on	III	115
Timbering, *see also* Coal Mining, Mining, Mine Timbering.		
Bankhead coal mine, Alta.	VIII	217
Boundary Dist., B.C.:		
Emma mine	X	193
Ironside and Knob-hill mines, paper by DEPENCIER	V	424–446
Mother Lode	V	214
Brayton Domain colliery, Eng.	IX	404
Coal Creek colliery	IV	162 et seq. 172

	Vol.	Page
Timbering—Con.:		
Costs, Rossland Dist., B.C.	VI	136–140
how chargeable in mine accounting	III	53
Darien mine, Columbia, S. America	VI	142
Los Reyes gold mines, Mexico	VIII	280
Michigan iron mines	VII	356
Quincy copper mine, Mich	X	402, 405, 406
Regent iron mines, Mich.	VII	325
Rossland Dist., B.C.:		
Centre Star	V	457, 459
costs	VI	136–140
LeRoi	V	315, 410, 418
paper by MACDONALD	VI	129–141
Steel used for shaft	VII	352, 356
Susquehanna Coal Co., Pa.	IX	382
Torbrook iron mine, N.S.	IX	32
Western Ontario goldfield	VI	330
Ymir mine, B.C.	III	8
Timbermen:		
Wages of, Phoenix, B.C.	V	446
Timiskaming, Ont.:		
Silver discovered in	VII	142
Timiskaming Lake, QUE.:		
Minerals at, notes by OBALSKI	X	107
Tin:		
Assaying	IV	225
Berthier Co., Que.	IX	72
Canadian imports of	VI	69
Cornwall, Eng., by-products	III	18
Notes by MILLER on occurrences	VI	35
Ontario occurrences of	VII	380
Royalty on:		
New Brunswick	VII	456
Nova Scotia	VII	458
Tin-stone:		
Crushing and sizing	IV	208, 210, 214, 221
Tipple:		
Coal Creek, B.C.	IV	157, 240
Mitchell, Coal Creek colliery, B.C., description	IV	240
Notes by HARDIE	IX	208
Tip Top copper mine, ROUND LAKE. ALG., ONT.	VII	383
Notes on by CARTER	VII	148
Titaniferous iron ore (MENACCANITE), *see also* Ilmenite.		
Assaying	V	44
Greenwater Lake, Ont.	V	59
Gröndal process for treating	VIII	156
Titaniferous iron sands:		
Electric smelting of	VIII	153
Magnetic separation	V	9
Titaniferous magnetite:		
Crushing	IV	210
Ontario	IV	265, 267, 269 et seq.

	Vol.	Page
Titanium:		
Atikokan Dist., Ont.	IX	299
Compounds	V	44
Determination of	VI	294
Electric smelting of, notes by EVANS	IX	132, 133
STANSFIELD	X	133
Elimination of in iron ores	VI	12
Hardness	III	197
St. Lawrence River, in iron sands	IV	94
	VII	279
Separation of	X	270
from iron sands	IV	94
	VII	279
Title (TO MINERALS):		
Ontario, on Indian reserves	III	113
timber reservations	III	115
Titusville, PA., U.S.A.:		
Oil-well	VI	43
Toad Mountain, NELSON, B.C.:		
Gold mining on	V	15
Toledo steel	IV	197
Tonkin, J. H.	VI	440
Tool(s):		
from Swedish iron	II	215
Tempering	VIII	297
Tool steel:		
Electric manufacture of	VIII	150
Topographical map(s):		
of Canada, need of, paper by ADAMS	IX	74 et seq.
Uses of	IX	78
Value of, notes by WHITE	VI	317
Topographical surveying:		
Methods	IX	80
of Can. Geo. Survey, notes by BELL	VIII	57
Staff, notes by ADAMS	V	586 et seq.
Topography:		
Atikokan, Ont.	IX	286
Atlin Dist., B.C.	III	101
	V	21
Bear Lake, B.C.	III	95
Boisdale Hills, C.B.	VI	412
Boundary Dist., B.C.	V	365
Bridge River Dist., B.C.	III	22–23
Chibougamau Dist., Que.	VIII	366
Conrad Mining Div., Y.T.	X	210
Goldfield, Nev.	VIII	40
Lardeau Dist., B.C.	VII	87
Laurentian Plateau, Que.	VIII	85
Megantic, Que.	VII	399
New Caledonia	VI	169
Notes by ADAMS on mapping	V	587
Ontario, Western, goldfields	VI	330
Quatsino Sound, V.I.	VI	198
Salmon River Dist., B.C.	III	4
Slocan Dist., B.C.	VI	147
Webster, N. Carolina	IX	304
Torbrook Dist., ANNAPOLIS COUNTY, N.S.:		
Iron prospecting in	IX	31–34

	Vol.	Page
Tornebohm, Prof.:		
Iron supplies of the world tabulated by	x	141
Toronto, Ont.:		
Meeting of Institute at, 1904	vii	1–25
1907	x	1–20
Torre del Greco, ITALY	vi	82
Tory, H. M.:		
Experiments of on melting points of metals	v	7
Tough, Robert	vii	498
Tourmaline:		
Hastings County, Ont	vii	240
Trachyte:		
Galicia	vi	77
Trail Mining Division, B.C., *see also* Rossland Dist.		
Notes by CAMPBELL	v	447
Ore deposits, notes by CORLESS	v	508
Rock drilling in	vi	376
Statistics, 1900	v	524
Trammers:		
Wages of	v	336
Rossland Dist., B.C.	v	458
Tramming:		
Centre Star mine, Rossland B.C.	v	460
LeRoi mine, Rossland, costs	v	316, 318
Northport smelter	v	318, 337
Mother Lode mine, Boundary Dist., B.C	ix	343
War Eagle mine, Rossland, B.C.	v	468
Tramway:		
Montana mine, Windy Arm, Y.T.	ix	51
War Eagle mine, Rossland, B.C.	v	468
Trand Gulch, ATLIN DIST., B.C.	v	26
Transcontinental Exploration Syndicate, GOAT CREEK, SKEENA DIST., B.C.	x	224
Coal seams	x	226
Transmission:		
Compressed air	v	160
Transportation:		
British Columbia:		
Atlin Dist.,	iii	101
Cariboo Dist., costs	vi	325
Crowsnest Pass,	iv	170
Franklin camp,	x	171
Lardeau Dist.,	vii	101
Minnesota iron ores	iv	282
New Caledonia, nickel	iv	189
Omineca Dist.,	x	228
Skeena River	iii	92
Ontario:		
northern	iv	279
Thunder Bay	iv	281
Rossland Dist., B.C., of ore	v	311, 314
		316, 334
	vi	228
LeRoi mine	v	410
Slocan Dist., B.C., 1899-1900	iii	16
	v	13
	vii	205
Spain, of iron ores	iv	197, 198
Yukon Territory	v	576
	x	209

	Vol.	Page
Transportation—Con.:		
Yukon—Con.		
Klondike	III	210
notes by WADE	V	600
Transvaal, S. Africa, *see also* Africa S.:		
Cyanidation in	IX	396
Deep mining	IV	40–41
Drilling	IX	394
costs	IX	389
Gold discovery	VI	27
production, 1890-1900	VI	25
Trap:		
Eastern Tps., Que.	V	81 et seq.
Telkwa River, B.C.	X	221
Travel, A. B.	IX	305
Treasurer of C.M.I., *see also* Stevenson, A. W., Brown, J. S. *and* Canadian Mining Institute.		
Report:		
1902–3	VI	443
1904–5	VIII	7
1906	IX	9
	X	9
***TREATMENT OF AURIFEROUS MISPICKEL ORES, THE.** KIRKEGAARD	IV	113–122
†***TREATMENT OF AURIFEROUS MISPICKEL ORES AT DELORO, ONT., THE.** WRIGHT	IV	143–151
‡***TREATMENT OF THE DRY ORES OF THE SLOCAN,** CAVERS	VII	199–207
Discussion on, by:		
MICKLE, KIRKPATRICK, PORTER, GWILLIM	VII	207–209
Trembling Mts., LAURENTIAN MTS., QUE.:		
Altitude of	VIII	85
Tremolite, (RAPHILITE):		
Boundary Dist., B.C.	V	369
Morrison mine	V	369
Eastern Tps., Que.	V	346
Trenton, ONT.:		
Water power at	III	139
Trenton formation:		
Huron-Erie peninsula, Ont.	II	187
Hydro-carbon products in	III	83
Natural gas in	III	80
	VI	97, 112
Ontario	II	210
	I I	69, 75
Petroleum in	VI	112
Indiana	III	82
Ohio	II	209
Ontario	III	69, 75
western	II	208 et seq.
Treptow, Prof.:		
Ref. to review of mineral industry by	VI	21
Triano, SOMORROSTRO DIST., SPAIN, *see also* Spain.		
Iron deposit	IV	198
Triassic:		
Texada Island, B.C.	X	243
Virginia and Kentucky coal	VII	500

* See Summaries, page 27
† " " 29
‡ See Summaries, page 80

	Vol.	Page
Trickett (and Noad) electrolytic process	v	204
Triggs mineral claim, Rainy River Dist., Ont.	vi	332
Trinidad, Colorado, U.S.A.	iv	235
Asphalt deposits	vi	89
Tripley electric pump	iv	239
Tripoli:		
Nova Scotia production, 1899	iii	189
Tripolite, *see* Infusorial earth.		
Triune silver-lead mine, Ferguson, B.C.:		
Notes by Brock	vii	97, 100
Trommels:		
Corundum concentration	v	167, 169
Helena Frisco mill, Idaho, U.S.A.	iv	256
Trout Lake, Lardeau Dist., B.C.:		
Formation at	vii	92
Tubal mine, Lake Superior:		
Analyses	ii	50
Tuck, T. J.,		
Death of	iii	179
Tuckaseegee River, N. Carolina, U.S.A.	ix	303
Tucker, A. E.	x	94
Tuff(s):		
Boundary Dist., B.C.	v	366, 367
Gallowscrook, Scotland	vi	77
Rossland Dist., B.C.	v	520
Tulameen Dist., B.C.:		
Platinum occurrences in	viii	199
Tungsten:		
Notes by Miller	vi	40
Tunnel(s):		
Athabasca mine, Nelson, B.C.	v	15
Bankhead coal mine, Alta.	viii	216, 218
Black Bear, Rossland, B.C.	v	330, 404
		470
Blackwell, England	v	161
Coal Creek colliery, B.C.	iv	167
plan	iv	163 (opp.)
Frank coal mine, Frank, Alta.	vi	374
Helena Frisco mine, Idaho	iv	254
Knob Hill mine, Phoenix, B.C.	v	424
Mother Lode mine, Boundary Dist., B.C.	v	216
	vii	43
St. Gothard, Switzerland, temperature	ii	142
Simplon, Switzerland, blasting system	ii	140
drill carriages	ii	140
method of refrigerating air	ii	142
ventilation	ii	141
Washington aqueduct, building	v	157
Ymir mine, B.C.	v	525
Tunnel-carriages:		
Simplon	ii	140
Tunnelling:		
Coal Creek colliery, B.C.	iv	167
Compressed air	v	161
Conveying water	vii	74
LeRoi mine, Rossland, B.C.	iii	165
Notes on by Brent	iv	174
Simplon, Switzerland	ii	137, 139

Tupper, Sir Charles.....vii 496
Tura River, RUSSIA:
Platinum in.....viii 196
Turgeon, A.:
Address to Institute.....iv 8
Turner, A. P......vii 282
Turtle Mt., DAKOTA, U.S.A.:
Coal on.....x 237
Turtle Mt., FRANK, ALTA.:
Coal mine at.....vi 232
Turtle Mt., MANITOBA:
Edmonton series at.....viii 223
Turtle Mt., SOURIS DIST., SASK.:
Geology.....vii 423
Tuscany:
"Suffionis".....vi 86
Twelve Mile Creek, SLOCAN DIST., B.C.....v 11
Twenty-Mile Creek, SIMILKAMEEN DIST., B.C.:
Copper ores.....iv 229
Tyee copper mine, MT. SICKER, VANCOUVER IS., B.C.:
Development of.....x 204
Notes by BREWER.....vi 194
Ore body of.....ix 46
Tyrifjord, NORWAY.....vii 405
TYRRELL, J. B.:
Discussions by, on:
1900 The Old Valley Gravels of the Klondike.....iii 214–217
1907 The Ore Deposits of the Cobalt District, Ont.....x 58
Notes by, on:
1906 Yukon gold mining.....ix 15
1900 occurrence.....iii 216
Papers by, on:
1906 ***A Canadian Department of Mines or Geological Survey***.....ix 107–111
1906 †***Yukon Mining Laws***.....ix 115–121
1900 Resolution by, on Yukon Gold Royalties.....iii 221
1906 Views on a Canadian Department of Mines.....ix 22
Tzartoos Island, BARCLAY SOUND, V.I., B.C.:
Iron ores.....vi 199
Tzesatzakwa River, SKEENA DIV., B.C.:
Coal discovery.....x 223

U

Uintaite, (GILSONITE) **Dist.,** UTAH, U.S.A.....vi 106
Ulke nickel refining process:
Description.....v 393
Diagram.....v 208
Ulke, Titus
Discussion by, on:
The Electrolytic Production of Metals with Special Reference to Copper and Nickel.....vi 338, 393, 394, 399, 400

* See Summaries, page 114
† " " 115

	Vol.	Page
Ulloa, Antonio:		
Platinum first described by	VIII	192
Undergraduates, *see* Students.		
Underground drainage:		
Types of, notes by ADAMS	VIII	78 et seq.
UNDERGROUND MINING METHODS AT THE QUINCY COPPER MINE, MICHIGAN, McLAREN	X	399–417
Underground note-books	VIII	326
Underground water(s), *see also* Water.		
Texas coastal plain	VI	93
Underwood, F. L.	IX	332
†***UNDEVELOPED MINERAL RESOURCES OF ONTARIO,*** MILLER	VII	377–392
Discussion on, by:		
GIBSON, BELL, R., MONTGOMERY, ADAMS, BARLOW, COSTE	VII	392–396
Ungava Bay:		
Iron ore	II	39
report by BELL	II	214
‡***UNIFORM MINING STATISTICS IN CANADA, ON.*** COSTE	VIII	169–171
Discussion on, by:		
COSTE, HOBART, GWILLIM	VIII	171
Union, VANCOUVER ISLAND, B.C.:		
Colliery near	VI	196
Anthracite occurrence	VIII	240
Union Gas Company:		
Log of well	III	71
United States:		
Asbestos production, 1900	V	347
1879-1901	V	350
1901	VI	71
Aluminum production	VI	68
Chrome consumption	IX	35
Coal:		
machine mining	VI	449
mining accidents	VI	448
production, 1850-1900	VI	31
1868-1898	VI	70
Copper industry	VI	34
production	VI	69
Cordilleran system in mineral wealth of	VII	468
Corundum production	VII	411
Electro-chemical industry	V	147
Export trade, 1898	II	57
Gold production, 1821-1900	VI	25
Graphite statistics	X	100
Iron industry, 1810	II	220
exports, to Canada, 1900	V	566
production, 1898	II	57
pig, 1898	II	52
1901	VI	6
reserves	X	140, 141, 146
and steel industry, notes by BIRKINBINE	V	218–227
production, 1807-1900	VI	29
trade conditions, 1899	III	118

* See Summaries, page 147
† " " 85
‡ See Summaries, page 99

	Vol.	Page
United States—Con.:		
Mica industry, 1899	IV	308
occurrences	VII	286, 287
Mineral production, notes by MACDONALD	VI	338
paper by JOHNSON	VI	66–72
Molybdenum	VI	64
Nickel occurrences	IV	184
production, 1901	VI	69
Phosphate exports	VI	71
Quicksilver production	VI	68
Steel trade	IV	24
Strike of coal miners in, effects on Canadian industry	VI	450
Technical education	V	146
United States Geological Survey:		
Archean, nomenclature of	VI	257
Artesian water, study by	VIII	84
Coal tests by	IX	322
Director's jurisdiction	V	585
Formational nomenclature by	V	50
HARDMAN, notes by	V	115
Mineral statistics of	VIII	162
compiling	VI	410
Topographical maps of	IX	76
Webster nickel mines, report by	IX	305
United States Steel Corporation:		
Notes on by HOBART	VI	315
Property of at Ely, Minn	VII	334
Universal Colliery, SOUTH WALES:		
Explosion at	V	379
GALLOWAYS' report on cause	VI	202
Universities:		
State aided, Germany	V	146
Scotland	V	146
Upper Selkirk series:		
W. Kootenay, B.C.	V	506
Upton, QUE.:		
Copper mines	V	81
Ural Mts., RUSSIA:		
Diamonds	III	155
Gold mining	VI	26
Platinum deposits	VIII	196
discovered	VI	36
Revdinskite	IX	307, 308
Uralite-porphyrite:		
Rossland, B.C.	V	450
Uranite:		
Madoc, Ont	VII	254
Ottawa River, near Quebec	VII	395
Quebec occurrences of	VII	245
Villeneuve mica mine	IX	72
Uranium:		
Uses	VI	44
Uranus silver mine, WINDY ARM, Y.T.:		
Vein on	IX	50
Workings on	IX	52

	Vol.	Page
***USE OF GRAPHIC FORMULAE IN METALLURGICAL CALCULATIONS, THE.** BROWNE	X	281–300
†***USE OF WOOD GAS IN THE MANUFACTURE OF IRON AND STEEL, ON THE.** DOUGLAS	V	178–182
‡***USES OF CHEMICAL ANALYSIS IN IRON BLAST FURNACE PRACTICE AND SOME NOTES ON LABORATORY METHODS, THE.** DRUMMOND	X	442–462
Utah, U.S.A.:		
Gilsonite	VI	106

V

V. & M. mine, SLOCAN DIST., B.C.	V	11
Vacuum:		
Following explosions	VI	206
Pumping, Harris system	V	268
Vacuum heater:		
Description of	VII	517
Vaeleren smelting works, NORWAY	VII	406
Vale colliery, PICTOU COUNTY, N.S.:		
Productive coal measures	V	358
Vale copper mine, ACTON, QUE.:		
Cement shaft-lining at	VII	434
Valhalla granite:		
Franklin Camp. B.C.	X	172
Valkyr Mt., LOWER ARROW LAKE, B.C.:		
Gold in porphyry	V	378
¶***VALUE OF UNDEVELOPED MINING CLAIMS, THE** MICKLE	VIII	111–117
Discussion on, by:		
COSTE, GOODWIN, GARDE	VIII	118
Valves:		
Air-cylinder, cleaning	V	160
Compressed air signalling	VI	166
Power drills, notes by HANSEN	V	486
Pumping, notes by HARDIE	VII	530
Vanadium:		
In titaniferous iron ores	IV	270
Van Anda Copper & Gold Mining Co., TEXADA, B.C.:		
Formation of	VIII	173
Vanassour mica mine, HULL TP., QUE.	VII	304
Vancouver Island, B.C.:		
Chalcopyrite	IX	42
Coal:		
analysis	VIII	237
measures	VII	424
Collieries on	VI	227
Copper deposition, paper by BREWER	IX	39–48
Economic Minerals, paper by BEST	V	228–232
Mineral Resources, paper by BREWER	VI	188–199
Vancouver Island Development Co.	VIII	174

* See Summaries, page 145
† " " 45
‡ See Summaries, page 149
¶ " " 96

	Vol.	Page
Vancouver series:		
Vancouver Island, B.C.	VI	189
	X	243
Vancouver silver-lead mine, SLOCAN DIST., B.C.	III	171
Van Hise, Dr. C. R.:		
Discussion by, on:		
The Cobalt Mining District	X	71
Notes by, on:		
circulating waters	X	59
cobalt nickel deposition	X	55
iron ore deposits, Lake Superior region	VI	248, 249
Paper by:		
***Ore Deposits of the Cobalt Dist., Ont., The**	X	45–53
Quoted on:		
Metamorphism	VIII	43
origin of Lake Superior iron	VII	260, 262
Michipicoten pyrite	X	125
Vermilion Range formation	VII	335, 336
Min. refs.	VI	250, 251
		252
	VII	367
	X	17
Van Horne, Sir W. C.:	VII	496
Vanners, *see also* Frue Vanners.		
Device to insure uniform feed for	IV	260
Notes by SNYDER	III	104–106
Van Petersdorff, C.:		
Report by on galena concentration	IV	263
Vansickle, LAKE TP., HASTINGS CO., ONT.	VII	216
Vault claim, CONRAD, Y.T.:		
Vein on	X	212
Vauquelin, Louis-Nicolas:		
Copper-platinum associations demonstrated by	VIII	198
"Vein granite":		
Butte, Montana	V	298
Velvet mine, ROSSLAND, B.C.:		
Production, 1894-1904	VII	47
"Vena":		
Hematite, Spain	IV	199
Venango-Butler oilfields, PA., U.S.A.	VI	111
Venezuela:		
Asphalt deposits	VI	89
Gold production, 1885-1900	VI	25
Vennor, H. G.:		
Report on graphite referred to	X	86, 90
Ventilating fans:, *see* Fans.		
Ventilation:		
Alberta Ry. and Coal Co., Lethbridge, Alta.	V	109
Black powder, effect on of using	I	4
Brayton Domain colliery, England	IX	409
British Columbia regulations	IV	164
Canmore coal mine, Alta.	V	109
Centre Star mine, Rossland, B.C.	V	465
Coal Creek colliery, B.C.	IV	239
plan	IV	163 et seq.
Colliery	IX	205
paper by PEACOCK	IV	107–112

* See Summaries, page 127

	Vol.	Page
Ventilation—Con.:		
Frank, Alta., coal mines	V	110
Pennsylvania regulations	IX	385
Simplon tunnel, Switzerland	II	141
Susquehanna Coal Co., Pa	IX	380, 385
Ventura iron ore deposit, SPAIN	IV	198
Venus claim, CONRAD, Y.T.:		
Notes by CAIRNES on	X	212
Venus No. 1 silver mine, WINDY ARM, Y.T.:		
Vein on	IX	50
Venus No. 2 silver mine, WINDY ARM, Y.T.:		
Vein on	IX	50
Vera Cruz:		
Asphalt deposits	VI	89
Verein Deutscher Eisenhentenleute:		
Excursion of to United States	X	136
Vermilion gold mine, SUDBURY DIST., ONT.:		
Platinum, (sperrylite) discovered in	VIII	198
notes by GOODWIN	VIII	210
WALKER	VIII	211
in ores of	VIII	204
Vermilion iron range, MICH.	IV	25
Freight rates on iron ore	IV	283
Note by WILLMOTT	VII	259
Ore deposition	IV	274
Pioneer mine, paper by CARLYLE	VII	334
Vermilion Lake, BANFF DIV., ALTA.:		
Coal seams	X	233
Vermilion Lake, TIMAGAMI DIST., ONT.:		
Jaspilyte	IV	278
Vermilion Mining Co., SUDBURY DIST., ONT.:		
Organization of	VII	499
Vermilion nickel mine, DENISON TP., ONT.:		
Platinum in ores at	VII	165
Vermilion River, SUDBURY DIST., ONT.:		
Gold-alluvial	II	105
	V	238
	VII	117, 381
dredging on	VI	470
Versailles, FRANCE:		
Treaty of	VI	317
Vesuvianite:		
Analysis of	X	248
Copper associated with	X	254
Vesuvius:		
Eruption of	VI	82
"Veta Madre", SAN MIGUEL PERAS, MEXICO	VIII	274
Viau & Frere:		
Artesian boring by	VIII	90, 92, 98
Victor box car loader	IX	268
Victoria, AUSTRALIA:		
Gold discoveries	VI	26
Victoria, B.C.:		
Formation	VI	189
Victoria Co., ONT.:		
Molybdenite, concentration tests on	VI	58
deposits in	VII	164

	Vol.	Page
Victoria galena mine, near SAULT STE. MARIE, ONT.	VII	142
Victoria Gulch, KLONDIKE, Y.T.	III	212
Victoria mineral claim, near LADYSMITH, B.C.:		
Bornite	VIII	177
Dyke	V	173
Victoria nickel mines, SUDBURY DIST., ONT., *see also* Mond Nickel Co.	VII	65
Depth of	IX	227
Discovery of	VII	497
Formation at	IX	224
Geological map and section of	IX	224 (opp.)
Notes on by CARTER	VII	150
Occurrence at	X	314
Platinum in ores from	VIII	203–204
Victoria, N.S.:		
Coal production, 1902	VI	445
Victoriahamn, SWEDEN	II	39
Villeneuve mica mine, OTTAWA CO., QUE.:		
Uranite	VII	245
	IX	72
Vinnwald, GERMANY:		
Lithia mica	VI	44
Vintjarn, SWEDEN:		
Iron	II	43
Virginia, U.S.A.:		
Coal, geological age of	VII	500
Coastal plain, formation	VIII	81
Diamonds discovered in	III	151
Mica	VII	287
Virginia mine, ROSSLAND, B.C.:		
Production, 1894-1907	VII	47
Vein	V	522
Virginia mineral claim, RAINY RIVER DIST., ONT.	VI	332
Virginius mineral claim, ROSSLAND, B.C.	V	447
Vivian, H. H. Co.:		
Mining operations of, Sudbury Dist.	III	225
	VII	499
Vivian, Sampson:		
Bruce mines leased by	X	151
Vizcaya Dist., BASQUE, SPAIN:		
Iron ore	IV	196
production	IV	197
Vogt, Prof. J. H. L.:		
Quoted on:		
Contact metamorphism	V	372
Nickel deposits of Norway	V	538
	X	278
Origin of pyrite	X	120
Platinum occurrences in Norway	VIII	207
Volcanic ash:		
Rossland Dist., B.C.:	V	520
Volcanic dykes:		
Bitumen in	VI	77
Volcanic emanations:		
Composition	VI	79

	Vol.	Page
Volcanic eruptions:		
Etna	VI	83
Mount Peleé, Martinique Island	VI	80
Santorum, Greek Archipelago	VI	83
Vesuvias	VI	82
Volcanic flames:		
Cause of	VI	84
Volcanic Oil & Gas Co., RALEIGH, ONT.:		
Gas well of	X	78
VOLCANIC ORIGIN OF NATURAL GAS AND PETROLEUM, THE. COSTE	VI	73–128
Discussion on, by:		
MICKLE, BELL, R.	VI	123–128
BELL, COSTE, LECKIE, MICKLE, HARDMAN, ADAMS, GOODWIN, MILLER	VI	473–477
Volcanic rocks:		
British Columbia:		
Boundary Dist., B.C.	V	367
South-eastern	V	507
Vulcanism:		
Eureka, Nev.	II	85
Evidences of	VI	87 et seq.
In the formation of ore bodies	II	84
Volcano, W. VA., U.S.A.	VI	105
Volcanoes:		
Hawaiian Islands	VI	71
Mt. Peleé, Martinique Island	VI	80
Von Goddick:		
Quoted on contact metamorphic deposits	X	177
Vorarlberg nickel concession, NEW CALEDONIA	VI	178

W

Wabana, NEWFOUNDLAND:		
Iron, analysis	X	373
mines	IV	26, 35
production, 1900	IV	311
1901	V	584
Wabana iron mines, NFLD.:		
Equipment	IV	65–67
paper by CHAMBERS	IV	63–67
Map	III	132 (opp.)
Metallic contents of ore	III	194
Mining methods	III	132
Output, 1899	III	122
Purchase by Dominion Iron & Steel Co.	III	131
	IV	66
Wabigoon, RAINY RIVER DIST., ONT.:		
Platinum discoveries, reported	VII	165
Wade, Frank C.:		
Address by on the Yukon	V	597

* See Summaries, page 61

	Vol.	Page
Wages (to miners):		
British Columbia:		
Atlin Dist.	III	101
Boundary Dist.	V	446
Crowsnest Pass (coal)	IV	172, 173
Rossland Dist.	V	336, 423
		458, 479
	VI	389
Nova Scotia	IV	45
Ontario:		
1898-1900	IV	302
1899	III	187
1900	IV	304
Quebec, asbestos industry	V	355
Russia, asbestos industry	VI	372
Spain, iron industry	IV	201
Sweden, iron industry	II	223, 224
Yukon	V	575
	X	210
Wahconichi Lake, QUE., *see* Wakonichi.		
Wahnapitae, *see* Wanapitei.		
Wakamatsu, JAPAN:		
Iron works	VI	30
Wakefield Dist., OTTAWA COUNTY, QUE.:		
Mica	IV	305
	VII	307
Wakefield silver-lead mine, SLOCAN, B.C.:		
Concentrator	VI	152
	VII	372
Wakonichi Lake, MISTASSINI DIST., QUE.	IX	17
Walcott, C. D.:		
Quoted on value of topographic maps	IX	85
Wales:		
Coke, quality	IV	236
Walker, Byron E. (*now* SIR EDMUND):		
Quoted on establishing museums	VIII	72
Walker graphite mine, BUCKINGHAM, QUE.	V	571
Walker Graphite Mining Co., BUCKINGHAM, QUE.	VI	76
	X	91
WALKER, PROF. T. L.:		
Address by:		
"On some Primitive Methods of Mining and Smelting in India"	VI	486
Discussions by, on:		
The Artesian and Other Deep Wells in the Island of Montreal	VIII	100
The Attraction of Minerals for Oil	VII	189, 190
The Distribution of Platinum Metals in Sources other than Placers	VIII	211
The Need of a Provincial Museum in Ontario	VIII	73
The Ore Deposits and Geology of the Sudbury District	IX	232, 233
Paper by, on:		
The Geological Survey of Canada as an Educational Institution	VII	435–438
Views on:		
A Canadian Department of Mines	V	596
Government employment of geological students	VII	448, 449
Min. refs.	VII	444

* See Summaries, page 89

	Vol.	Page
Walker River, Nevada, U.S.A.	x	257
Wallace, R. W.:		
On the application of electricity	iii	134
Wallaceburg, Kent Co., Ont.:		
Section of oil well	ii	188
Wallbridge iron mine, Madoc Tp., Hastings Co., Ont.	iv	268
Walsh, James:		
Discussion by, on:		
Suggested Improvements to the Mining Laws in Canada	vii	474
Wanapitei, Dryden Tp., Nip., Ont.:		
Gold	v	238
mines at, notes by Carter	vii	121
Wanapitei River, Wanapitei Lake, Nipissing:		
Gold on, alluvial, notes by Carter	vii	117
War Eagle mine, Rossland, B.C.:		
Country rock	ii	74
Drilling at	ix	388
Dyke	v	173
Formation	v	519
Head-frame	v	467
Hoist	v	464
Located	v	447
Mineral production, 1894-1904	vii	47
Notes by Kirby on ore deposits at	vii	48 et seq.
Stoping costs	v	414
Surveying methods at	viii	317
Vein	v	522
WARDEN, B. R. (and STOCKETT, L.):		
Anthracite Breaker of the Pacific Coal Company, Limited, Bankhead, Alta.	ix	261–271
Waresco claim, Telkwa River, B.C.	x	222
Wash room:		
Centre Star and LeRoi mines, Rossland, B.C.	v	475, 476
Washing plant:		
Wesselton diamond mine, S. Africa	v	65 et seq.
Washington aqueduct tunnel:		
Air compressing plant	v	157
Washington mine, Slocan, B.C.:		
Concentrator	vi	152
	vii	372
Water(s):		
Ascending, vertical distribution of different ores by	x	256
Boring for, Montreal, Que	viii	76
Decomposition of, by electricity	iii	133
Coke	iv	136
Hawaiian Islands, methods of obtaining for sugar plantations	vii	70–81
Magmatic, paper by Hixon	x	301–308
Martin, Texas, character at depth	vi	93
Mine, pumping	iii	146
Mineral, deposition due to	v	55
Miners' inch of	x	420
Pumping, by compressed air	v	265–273
at high temperature	vii	527

* See Summaries, page 121

	Vol.	Page
Water(s)—Con.:		
Source of salts and sulphurous ingredients in	VIII	100
Stamp mill practice	II	154
Underground, Butte, Montana	X	253
notes by ADAMS	VIII	79
CORLESS	V	527
Water-cooler:		
Calcining furnace	VI	307
Water gas, *see also* Gas.		
Loomis-Pettibone generator	V	178
Water gas plant:		
Description of by SJOSTEDT	VIII	290
Water heaters:		
Paper by HARDIE	VII	505–530
"Water-level":		
Western Ontario goldfield	VI	330
Water power:		
Air compression from, paper by KERR	VI	233–244
Canada	III	138–139
notes by LECKIE	VI	467
Compared with steam for generating electricity	III	137
Dala River, Sweden	II	43
Fish River, B.C.	VII	96
Kopperberg Co., Sweden	II	42
Madawaska River, Ont.	VII	161
Quebec	X	111
Great Natashquan River	IV	97
West Kootenay, B.C.	VI	180
Zinc smelting	VIII	130
Water supply:		
Cariboo hydraulic mine, Bullion, B.C.	X	421
Goldfield, Nevada	VIII	39
LeRoi mine, Rossland, B.C.	V	338, 475
Water-wheel:		
Belmont mine, Ont.	VI	237
Power derived from	VIII	122
Watering (in coal mines):		
Coal Creek colliery, B.C., system	IV	239
Watson River, Y.T.	X	214
Watson, William:		
Platinum described by	VIII	192
Watten Tp., RAINY RIVER DIV., ONT.:		
Pyrite deposits in	VII	158
	X	125
Waverley gold mine, HALIFAX CO., N.S.	IV	53
Webber, J.	VI	50
Webster, NORTH CAROLINA, U.S.A.:		
Genthite (analyses)	IX	307
Nickel, paper by BARLOW	IX	303–316
Websterite:		
Webster, N. Carolina	IX	304, 312
Wedges:		
Cost of sawing for mine timbering	V	473
Weed, W. H.:		
Quoted on:		
Distribution of different ores by ascending waters	X	256
Secondary enrichment, at Butte, Mon.	X	253
Min. ref.	X	251

	Vol.	Page
Weedon Tp., QUE.:		
Copper bearing rocks of	VIII	260
Weir, Col. John	IX	332
Welded pipe:		
Bursting tests on	VIII	54
Welding:		
Gas consumption in	VIII	295
Welland County, ONT.:		
Geology	III	75
Natural gas	II	210
	VI	474
	VII	427
rock pressure	III	83
	VII	115
in Trenton formation	II	210
Oil and natural gas	III	79, 82
Wellington, NANAIMO, V.I., B.C.:		
Coal seam at	VI	188, 195
Wellington camp, BOUNDARY DIST., B.C.:		
Geology	V	366
Wellington coal seam, NANAIMO DIST., V.I.	VI	196
Wellington copper mine, BRUCE MINES DIST., ONT.	VII	144
Wellington section, BRUCE MINES, ONT.	X	151
Wellman furnace	X	377
WELLS, J. WALTER:		
Discussion by, on:		
The National Importance of Mining	V	151
Papers by, on:		
**Molybdenite, its Occurrence, Concentration and Use*	VI	47–65
†*Progress in Magnetic Concentration of Iron Ore*	VI	6–20
Wells & Penfield:		
Quoted on identification of sperrylite	VIII	198
Welsbach, Auer von:		
Gas mantle patented	VI	43
Welsbach lamp:		
Illuminating capacity of	VIII	300
Wendigo gold mine, L. OF THE WOODS, ONT.	VI	332
Wenstrom separator:		
Notes on by WELLS	IV	17
Wentworth, CUMBERLAND CO., N.S.:		
Copper	III	189
smelter	V	584
Wesselton (Premier) diamond mine, S. AFRICA	V	62
WEST, HOWARD:		
‡*The Small Economies in Mining*	III	11–20
West Australia, *see* Australia, West.		
West Canada Mining Co.	X	151
West End silver mine, THUNDER BAY, ONT.	VII	141
Vein at	X	54
West Kootenay, B.C., *see* Kootenay, West.		
¶*WEST KOOTENAY NOTES,* BROCK	III	141–144
Discussion on, by:		
WM. BLAKEMORE, E. COSTE, J. B. SMITH	III	198–199

* See Summaries, page 60
† " " 58
‡ See Summaries, page 15
¶ " " 23

	Vol.	Page
***WEST KOOTENAY ORE BODIES,** BROCK	II	72
West Kootenay Power & Light Co.	VI	181
West Virginia, U.S.A.:		
Coal-gas tests	IX	325
Oil and gas fields	III	81
	VI	105
Steam tests on coals from, by U.S. Geol. Survey	IX	322
Western Development Co., SKEENA RIVER, B.C.	X	224, 227
Western Sumatra, *see* Sumatra.		
Westman's calcining furnace	II	50
Weston, T.C.	X	352
Westphalia, GERMANY:		
Strontianite	VI	44
Westville formation:		
New Glasgow, N.S.	V	359
Millstone grit of	V	358
Pictou Co., N.S., geological section	V	361, 362, 363
Wetherbee:		
Quoted on weight of charcoal from different woods	II	46
Wetherill magnetic separator:		
Experiments with at McGill University	V	9
Molybdenite	VI	53
Notes on by WELLS	VI	13
Tests with on nickel ores	VII	280
Wharton, Joseph:		
Exhibit of manufactured nickel	IV	184
Min. ref.	VIII	212
Wheaton River, Y.T.:		
Stibnite on	X	214
Wheatstone:		
Dynamo improvements of	III	134
Wheelock, Fletcher	IX	33
Wheelock, Josephine	IX	33
Wheelock shaft, TORBROOK, N.S.:		
Iron analyses	IX	34
Sinking of	IX	32
White, Byron N.:		
Work by on Pueblo mine	X	215
White, I. C.:		
Report by on natural gas and petroleum referred to	III	84
WHITE, JAMES:		
Discussion by, on:		
The Stratigraphy of the Cascade Coal Basin	VIII	234
Paper by, on:		
†***Economic Geography***	VI	317–326
Min. refs.	VI	467–468
	VII	210
	VIII	21
White, Robt. & Co.	VIII	92
White arsenic, *see also* Arsenic.		
Analysis	IV	122
Ontario production	V	241
Uses	V	250
White ash, *see also* Ash.		
For charcoal	II	46

* See Summaries, page 7
† " " 69

	Vol.	Page
White Bear mine, ROSSLAND, B.C.:		
Production, 1894-1904	VII	47
White Bear Mining Co., ROSSLAND, B.C.	VII	69
"White dykes":		
S. E. British Columbia	V	508
White Horse, Y.T., *see* Whitehorse, Y.T.		
White Knob, IDAHO, U.S.A.:		
Mineralized garnet zone at	X	178
White lead:		
Manufacture of	VIII	246
White Pass railway:		
Profits	V	600
White pine, *see also* Pine.		
For charcoal	II	46–47
White River, ALASKA:		
Copper deposits	X	196
Whitefish Lake, MICHIPICOTEN RIVER, ALG., ONT.:		
Animikie formation on	VI	247
Whitehorse, Y.T.:		
Copper at	VIII	174, 179
	X	196
bornite	IX	40
notes by CAIRNES	X	214
Mining conditions at	X	209
Molybdenite at	VIII	179
WHITESIDE, O. E. S.:		
Papers by, on:		
**Across the Pitch versus Up the Pitch*	II	17
†	IV	126–130
Whitewater Deep mine, B.C.	II	80
Whitewater mine, WHITEWATER, B.C.:		
Concentrator, notes by FOWLER	VI	152, 155
Lead ore, character of	VI	156
Whitfield, NORTH STAFFORDSHIRE, ENG.:		
Colliery explosion at	V	382
Why Not mineral claim, Bridge River Dist., B.C.	III	27
Whycocomagh, INVERNESS CO., N.S.	II	69
Iron ores	V	584
Wickes, L. Webster	IX	57
Wickham Tp., DRUMMOND CO., QUE.:		
Copper mines	V	81
WICKWARE, FRANK G.:		
Awarded President's gold medal, 1907	X	6
Paper by:		
‡*British Columbia Copper Company's Mines and Smelter, The*	IX	333–374
Wigan, LANCASHIRE, ENGLAND:		
Colliery explosion	V	390
Wigwam River, EAST KOOTENAY, B.C.	IV	229
Wilberfore, HALIBURTON CO., ONT.:		
Rock movements near	VII	178
Wilcox copper mine, PARRY SOUND, ONT.	VII	142
Notes on by CARTER	VII	146
Wild Horse Creek, B.C.:		
Gold discovery	III	3
North fork of, ore bodies on	III	6

* See Summaries, page 3
† " " 28
‡ See Summaries, page 125

	Vol.	Page
Wiley Bros.	VII	155
Wilfley, A. R.	II	26
Wilfley table(s):		
Alamo mine, B.C., replacing round buddles	III	20
Coeur d'Alene Dist., Idaho	IV	262
Chromite concentration	II	26
Compared with magnetic separator for oversize products	VI	56
Corundum concentration	V	169, 170
Deloro Mill, Ont.	IV	118
Efficiency	III	170
Molybdenite concentration	VI	53
Wilkes-Barre colliery, PA., U.S.A.:		
Fire-damp	VI	203
Willard Brook, DUDSWELL TP., RICHMOND CO., QUE.	VIII	260
Williams, Prof. G. H.:		
Rock determination by, from Blezard mine	IX	233
Websterite described by	IX	312
Williams, Harry J.:		
Elected Councillor, C.M.I., 1905	VIII	34
1906	IX	27
WILLIAMS, H. J. CARNEGIE:		
Papers by:		
**The Bruce Mines, Ontario, 1846-1906, The*	X	149–167
†*Responsibility of Mining Engineers and Mining Directors,*	IX	281–284
Min. ref.	X	19
Williams iron mine, SAULT STE. MARIE, ONT.	VII	154
WILLIAMS, J. N. S.:		
Papers by:		
‡*Crude Petroleum and its Application as Fuel for Industrial Operations in the Hawaiian Islands*	VIII	59–67
¶*Methods of Obtaining Water Supply for Sugar Plantations in Hawaiian Islands*	VII	70–81
Williams, W. Y.:		
Supt. Knob-Hill-Ironsides mines, Phoenix, B.C.	V	424
Willis, Baylie	X	17
Willis, Major E.	IX	305
WILLMOTT, A. B.:		
Elected Councillor of Institute	VIII	34
Papers by:		
‖ *Exploration of the Ontario Iron Ranges, The*	VII	257–265
%*Origin of Deposits of Pyrites, The*	X	118–128
Min. ref.	X	169
Willow Creek, ATLIN DIST., B.C.:		
Gold-bearing gravel	V	24
production, 1900-1901	V	32
Notes by GWILLIM	V	26 et seq.
Willow Creek, south of CYPRESS HILLS, SASK.:		
Coal at	X	237
Wilson, Dr. A. W. G.:		
Min. ref.	X	12
Wilson, Prof. J.		
Calcium carbide discovered by	II	227
Wilson, W. J.	X	107

* See Summaries, page 134
† " " 122
‡ " " 94
¶ See Summories, page 75
‖ " " 81
% " " 132

	Vol.	Page
Wilson, Dr. W. P.	VI	319
Winch:		
Design for gold-dredge	V	94
Winchell, A. & H. V.:		
Quoted on:		
Canadian extension of Minnesota iron range	IV	282
Wind Mt., CASCADE COAL BASIN, ALTA.	VIII	227
Windermere Dist., B.C.:		
Galena	III	185
Windigo Lake, MICHIPICOTEN DIV., ALG., ONT.		
Basic rocks near	X	69
Winding engines:		
LeRoi mine, Rossland, B.C.	V	328
Winding rope:		
Notes on by HARDIE	V	23 et seq.
Windy Arm, TAGISH LAKE, Y.T.	IX	51
Mining at, notes by CAIRNES	X	210
Silver veins	IX	49–53
"Windy Arm formation":		
Rocks of	X	211
Winnipeg mine, BOUNDARY DIST., B.C.:		
Pyrrhotite, gold values in	V	373
Winquist, John	VII	102
WINTER, E. E.		
****The North Shaft Mine of the Susquehanna Coal Co., at Nanticoke, Pa.***	IX	375–386
Wire:		
Canadian exports, 1903-04	VIII	132
Wire rope(s):		
Breaking strength	V	35
Canadian exports, 1900	IV	315
statistics, 1902	VI	455
Construction	V	38
Elongation	V	38
Notes by GARDE	VI	305
Paper on by HARDIE	V	33–41
Testing	IV	42
†***WIRE ROPES, ON,*** HARDIE	V	33–41
Wisconsin, U.S.A.:		
Diamonds discovered in	III	151, 152
	IX	124
Zinc concentration practice	VII	376
Wishaw colliery, SCOTLAND:		
Explosion at	V	383
Witherbee, Sherman & Co.	X	111
Witherite:		
Uses and occurrence	VI	44
Woakes, Ernest:		
Discussions by, on:		
Mine Timbering by the Square Set System at Rossland, B.C.	VI	141–143
Notes on the Ymir Mine and its Mill Practice	III	169
Min. ref.	VI	441
Wolf safety lamp:		
Cause of colliery explosion	V	386 et seq.
Disadvantages of	VI	201
Marsant's experiments	VI	207

* See Summaries, page 125
† " " 38

	Vol.	Page
Wolfram, *see also* Tungsten.		
Ontario	VII	379
Wollastonite:		
Associated with copper	X	254
Platinum associated with	VIII	202
Wolverine copper mine, MICH., U.S.A.:		
Production costs at	X	415
Wolverine mineral claim, BOUNDARY DIST., B.C.:		
Note by BROCK	V	368
Woman Lake, ALGOMA DIST., ONT.:		
Jaspilyte	IV	280
Wood:		
Fuel for iron manufacturing	II	42
Gasification, notes by DOUGLAS	V	178–182
Wood alcohol:		
As bye-product of charcoal	II	51
Wood gas, *see also* Gas.		
Analyses	V	181
Wood Mt., SASK.:		
Coal on	X	235, 237
Edmonton series	VIII	223
Wood pulp:		
Industry allied with mining in Sweden	II	42
Kopperberg Co., Sweden, production	II	42
Limestones suitable for making	IV	153
Notes by GOODWIN	V	148
Woodbridge farm, COLCHESTER TP., ESSEX CO., ONT.:		
Natural gas	III	73
Woodbury concentrator, SLOCAN DIST., B.C.	VI	152
Woods, H. H.:		
Report by on Golden Star mine, L. of Woods, Ont.	VII	136
Woodward, J. R.:		
Views on copper deposits, Eastern Tps.	V	610
Woonsocket, SOUTH DAKOTA, U.S.A.:		
Artesian wells, pressure of	VIII	84
Worthington mine, BLEZARD TPS., ALGOMA, ONT.:		
Discovery of	VII	496
Gersdorffite	V	536
Nickel	III	225
Purchased by Dominion Minerals Co.	VII	499
WRIGHT, SIDNEY B.:		
****The Treatment of Auriferous Mispickel Ores at Deloro, Ont.***	IV	143–151
Wright Creek, ATLIN, B.C.:		
Gold	III	98
production, 1900-1901	V	32
Notes by GWILLIM	V	26 et seq.
Wright furnace	VI	306
Wright lead mine, LAKE TIMISKAMING, QUE.	IV	308
Wrought iron:		
Äg and Korsä works, Sweden	II	44
Bursting tests on pipe made from	VIII	53, 54
†***WROUGHT PIPE-THREADING AND RELATIVE DURABILITY OF STEEL AND IRON,*** SPELLER	VIII	46–55
Wulfenite:		
Occurrence	VI	40

* See Summaries, page 129
† " " 93

Y

	Vol.	Page
Yellow Birch, *see also* Birch.		
For charcoal	II	46
Yellow Pine, *see also* Pine:		
For charcoal	II	47
Yellowhead Pass:		
Coal measures	VI	225
Railway construction, notes by WHITE	VI	324
Yellowstone mine, SHEEP CREEK, NELSON DIV., B.C.	III	3
Yellowstone Park:		
Geysers in	X	305
Yerington, NEV., U.S.A.:		
Copper deposits of, paper by JENNINGS	X	257–260
Ymir mine, NELSON DIST., B.C.:		
Notes on, by CORLESS	V	525
Paper by FOWLER on, and mill practice	III	3–10
Ymir Mt., WILD HORSE CREEK, NELSON DIST., B.C.	V	525
York Branch River, MADAWASKA RIVER, ONT.:		
Corundum on and near	VII	418
York Harbour, NFLD.	VI	391
Young's Creek, BOISDALE HILLS, C.B.	VI	412
Young, Hon. John	X	367
Younge, R. J.	VIII	17
Yttrium:		
Note by MILLER	VI	43
Yukon Territory:		
Bornite ores of, paper by BREWER	VIII	172–180
Coal in	III	212
	X	216
mining, 1900	IV	296
production, 1900	V	564
1902	VI	445
Gold consignments to United States, 1900	III	214
mining, 1905, notes by TYRRELL	IX	15
occurrence	III	216
production, notes by JOHNSON	VI	69
	IV	293, 295
		296
1901	V	568
royalties	III	211, 212
		213, 214
		215
	IV	296
Mineral production, 1900	V	564
1902	VI	453
Miners' license	III	215
Mining and commercial progress, address by WADE	V	597
conditions and statistics, 1901	V	574–577
regulations, notes by COSTE	VII	458, 462
in southern, paper by CAIRNES	X	209–217
Quartz mining possibilities	III	212
veins, origin of	VII	234
Revenue from gold royalties	III	221
1901	V	597
Silver production, 1901	V	569
Yukon goldfields:		
Latitude	VI	46
***YUKON MINING LAWS,** TYRRELL	IX	115–121
Yukon River, Y.T.:		
Steamers on	V	600

Z

	Vol.	Page
Zaffre, *see* Matte.		
Zenith zinc mine, ROSSPORT, ONT.	VII	156
Zinc:		
Assaying	IV	225
Attraction of, for oil	VII	187, 188 189, 190
Bromo-cyanide process	IV	143, 149
Concentration	VI	19
Cyanide process, consumption	V	285
Deposition of, notes by KEMP	X	255
Electric smelting of, paper by SNYDER	VIII	119–131
First used as a distinct metal	VI	36
Kingsley process of separating	VIII	252
Magnetic separation of	V	8
Ontario mines, notes by CARTER	VII	155–157
occurrences, notes by MILLER	VII	383
Penalization of by smelters	VII	372, 374
in Slocan Dist.	III	16
Producing countries	VI	36
Smelting of	VII	275
	VIII	127
Australia:		
Broken Hill, N.S.W.	VIII	161
British Columbia:		
Paper by GARDE	VII	368–376
Boundary Dist.	V	369
in calcite gangue	V	516
Kimberley Dist., North Star mine	V	512
Lardeau Dist., Fish River	VII	96, 97
Poplar Creek	VII	109, 112
Rossland Dist.	V	452, 522
Slocan Dist.	III	10
Bosun mine	III	19
notes by FOWLER	VI	149 et seq.
Slocan Star mine	V	509
smelting of	III	16
	VII	372, 374
Statistics, 1906	X	185
Ontario	VII	109, 112
Dorian Tp.	VII	155
Rainy River Dist.	VI	334
Statistics, 1901	V	581
1902	VI	464
1903	VII	392, 429
Quebec:		
Statistics, 1898	II	65
United States:		
Coeur d'Alene, Idaho	IV	255
Missouri	X	311
Yukon:		
Windy Arm	IX	51
Zinc oxide:		
Reduction of	VIII	127
Zymoetze (or Copper River), SKEENA RIVER, B.C.:		
Mineral-bearing rocks on	X	221

* See Summaries, page 115

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1
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Index
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